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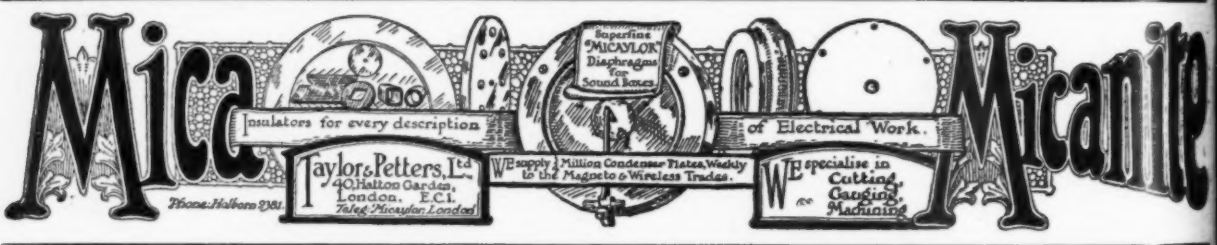
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Imperial Wireless Telegraphy.

DURING recent months the attitude of the Postmaster-General towards Imperial wireless telegraphy has been the subject of discussion, at times somewhat acrimonious, in the columns of the daily Press and at public functions, both at home and in the Dominions. Sir Robert Donald, chairman of the Committee appointed by the late Government to consider the reorganisation of wireless services, opened the ball with articles in the Press accusing the Postmaster-General of ignoring the views embodied in the draft report of his Committee, which has never been published.

Sir William Mitchell-Thomson promptly replied, pointing out that he had drawn up a scheme which was approved by Sir Arthur Balfour, a business member of Sir Robert Donald's Committee. Sir Robert, however, denied that the system adopted by the Postmaster-General was "an improved business organisation."

Further criticism of the Post Office policy was uttered by Sir Alfred Mond, M.P., and Lord Burnham at a meeting of the Council of the Empire Press Union last month. The former said it was clear that the Post Office did not like wireless. Sir Robert Donald's Committee, of which he was a member, was continually having impressed upon it how unimportant wireless was compared with the daily cable and telegraph routine of the Post Office.

In the meantime there is still no Imperial wireless service in operation, and opinion in the Dominions is growing restive at the delay. A *Daily Telegraph* correspondent says the view is still held in Australia that the less the British Post Office has to do with the control of Empire wireless the better.

The *Cape Times* says that if the British Government is anxious to provide the elements in South Africa hostile to Great Britain with a reason why they should treat British trade interests with no more concern than trade with other nations, it could not possibly furnish

anything more devastating than the persistent refusal of the British Post Office to co-operate in the carefully determined wireless policy of two successive Union Governments. The Minister of Posts and Telegraphs in South Africa, in the House of Assembly on April 3rd, expressed surprise at a statement of the British Postmaster-General that there had been delay in the erection of the beam station. He had cabled to the Post Office to see what the position was, but had not received a reply.

The Postmaster-General has stated that the high-power station at Rugby is expected to be completed about November next, and that stations for communication with Canada and South Africa, which are to be erected at Bodmin and Bridgwater, are to be completed by October next. Sites have been selected for stations for communication with India and Australia, and negotiations for their purchase are proceeding. Invitations have been issued to the Dominions and India to nominate representatives to serve on a permanent Committee under the chairmanship of the Assistant Postmaster-General, to advise on the practical details of the working of the Imperial wireless services, and some of the Dominions have accepted.

The Postmaster-General hopes that through the medium of this Committee it will be possible to obtain general agreement between the Imperial Government and the Dominions. We trust that the work of this Committee will justify Mr. Baldwin's statement in the House of Commons, that arrangements in connection with the institution of the Imperial wireless service were proceeding satisfactorily. Much remains to be done in spite of the Premier's welcome assurance, and we are convinced that only when those in authority acquired proper conception of the truly enormous possibilities of future wireless will the success of the Imperial Wireless Service be attainable.

A Contract Specification Criticised.

Our attention has been drawn to a specification that has been issued to would-be tenderers for the electric generating plant and motors required by the Metropolitan Asylums Board for the Leavesden Mental Hospital. Complaint is made that a particular make of generator is stipulated for, while the electric motors have to be made by one of six named manufacturers. It is not unnatural, as occasionally happens, for the engineer responsible for a specification to acquire, as the result of his experience, a preference for a particular type of machine; yet even in these cases it is not unusual for him to express his willingness to consider tenders for others of approved make. When no option is left to the tenderer to submit an alternative offer with a reasonable hope of its receiving consideration on its merits, the manufacturer is justified in the view that this should be made plain in the official announcement, thus sparing him the trouble of applying and the disappointment of finding that not only has time been wasted, but for some reason or other his own product is not considered approvable. We have not the criticised specification before us, nor are we familiar with the reasons which have led to the above course being adopted, but on the question generally we still hold the view that tendering should be left open for all likely types to compete, but failing that, matters should be so arranged that manufacturers' time is not wasted when there is not even a remote chance of their being successful in securing the business.

Here and There.

Whatever may be the causes for the continued unsatisfactory state of employment in these islands and for the improvement that is taking place in Germany, we think that a comparison of the latest published figures should impress upon those who can influence the course of British contracts, how necessary it is to keep work in this country, and upon those who are connected with public works and undertakings overseas, how desirable it is that they should lend a hand in the recovery of British manufacturing industry. During the fortnight ended April 15th, the number of unemployed in receipt of relief in Germany *fell* from 466,000 to 394,000, that is, by 72,000. In this country our registered unemployed during the fortnight ended April 13th *increased* by 10,500, to 1,204,000. Allowing for differences in the method of inclusion obtaining in the two countries we still have the important result of the tendency in the same period, Germany experiencing a substantial improvement in employment while we receded to a less favourable position, an unfortunate fact which becomes more distressing when we note that for the whole year we record an increase of 152,154 on the register. These figures, coupled with the information already made public regarding the great difficulty under which many of our general engineering concerns are operating at the present time, and with the employers' statement that the German menace to their trade has become very real, ought to carry great weight with all municipal authorities and their engineers. We believe that with a few exceptions they are allowed to do so, and we appeal to these exceptions to do the right thing and assist the industries of their own land. The engineers and directors of privately-owned industrial undertakings, collieries, mills, works, and so forth, whose doings only more or less accidentally reach the light of day, require to be told that their want of patriotism and their lack of practical interest in finding work for their own kith and kin, are not the less reprehensible because they can be kept within the privacy of the board room until the plant begins to show itself on the ground.

The Mond Scheme and Electricity Supply.

A pamphlet was recently issued by Sir Alfred Mond embodying his scheme for remedying unemployment, which was summarised in our "Business Notices" last week. Whether there is anything in it for the electricity supply industry remains to be seen—and this will, of course, depend on the terms of the Act which will be necessary to give effect to the scheme. In the electricity supply industry there is, fortunately, not a big margin of unemployed, compared with many other industries, the number being probably, say, 5 per cent. or thereabouts. Still, there is a much bigger number of available unemployed, since those in the electrical manufacturing industry are similarly skilled in considerable numbers. The Mond scheme, broadly, is, that for a definite period, employers shall receive the unemployment benefit payments for such men as are specially taken on in accordance with the conditions of the scheme. If the scheme could be made applicable to the electricity supply industry there would be a special advantage since the financial assistance so given would reduce capital costs of new work and so be of permanent advantage, as it would be reflected in the cost of supply. The particular work which might with advantage be so taken in hand would be the extension of the distributing system. Every extension which an undertaking can make is one little contribution towards that comprehensive network which would sooner or later cover the whole country. Whether the Mond scheme can assist is a matter which the associations of the industry might well consider.

Social Insurance.

Amongst the important matters dealt with by the Chancellor of the Exchequer in this year's Budget was the extension of the scheme of National Insurance by the inclusion of pensions to widows, allowances for orphaned children and old age pensions. If these proposals eventually become embodied in an Act of Parliament it would seem appropriate to alter the present title of the Insurance Acts, as neither "health" nor "unemployment" include the new objects. For the consideration of the Chancellor we suggest the title of "National Health and Social Insurance."

Although the Bill required to carry out the scheme is ready, details were not given except in general terms. Shortly these are that widows of men insured who die after January 4th, 1926, will receive a pension of 10s. per week for life and allowances for the eldest child of 5s., and other children of 3s., per week until they reach the age of 14. From January 4th, 1926, existing widows of men who were insured under the National Insurance Acts who are now mothers, will be pensioned and allowances made as before mentioned, with certain modifications.

From January 6th, 1928, all who have been contributors to health insurance for five years and who have paid under the new scheme two years' contributions will, at 65, receive a pension of 10s. per week irrespective of means, test or other disabling conditions.

From July 1st, 1926, an insured person will be entitled to a pension at 70, irrespective of means, so that an incentive to saving will be given.

Everybody recognises that these proposals will be expensive, and whilst none will object to the amelioration of social conditions which will result, additions to the high rates of contributions, particularly in respect of unemployment, which are now current, will be felt somewhat severely in the present disturbed state of trade, and if some way can be found to compensate industry for the additional charges, it will, no doubt, help materially to smooth the way for an easier passage of the necessary legislation.

A meeting of the Industrial Group of the House of Commons met two days after the introduction of the Budget, and it is stated that after thoroughly examining the proposals, they felt that whilst these will impose a heavy tax on industry, manufacturers will be prepared to make great sacrifices in order to secure peace in industry, and if the scheme will tend to allay unrest amongst the workers, it should receive favourable consideration.

The Tranquil Ether.

In a letter to *Nature* of April 18th, Prof. A. A. Michelson gives an account of recent experiments which he and Prof. H. G. Gale have carried out on the propagation of light rays round a closed circuit in opposite directions. If the luminiferous ether were carried along with the earth in its rotation, the circuit would be traversed in both directions in the same time; but if the ether were stationary with regard to the earth, the times would be different, and the difference could be measured by the method of interference.

The circuit consisted of a rectangle with a perimeter of more than 6,000 feet, of piping 12 in. in diameter, from which the air was exhausted to a pressure of half an inch. No fewer than 269 observations were made, the result being the definite conclusion that the ether traversed by the light waves was at rest. Thus at last, if these experiments are accepted as conclusive, a problem which has long defied solution has been solved.

From letters which appear in the current issue of *Nature*, it appears that the validity of the test is accepted by authorities no less than Sir Joseph Larmor and Dr. J. H. Jeans. The former points out that the astronomical aberration of light was discovered and elucidated on a basis which required the ether to be stagnant, and comments on the high degree of refinement of the new determinations. The latter considers the experiments of fundamental importance, but points out that they do not afford a means of deciding between the two remaining possibilities—that the ether is stationary, bodies moving through it undergoing contraction; or that there is no ether at all. The results are in accordance with the theory of relativity, the position of which is therefore unaffected.

The I.E.E. Roll of Honour.

The publication of the Roll of Honour of the Institution of Electrical Engineers carries us back in thought to the days when its members were eagerly offering their services for the defence of the Motherland, and the House of the Institution was for the time converted into a recruiting station. No fewer than 2,000 members out of the total membership of 7,000 entered the Navy, the Army, or the Air Force, and rendered invaluable service to the nation, their technical knowledge and their practical training enabling them very quickly to become expert in their new duties, though in the earlier days their exceptional qualities were not fully appreciated, and they were therefore not always employed to the best purpose. The record shows that of those high-souled volunteers one hundred and sixty-two gave their lives for their country. "So died these men as true sons of the British Empire."

The War Memorial Committee has been engaged for over five years in the preparation of this sumptuous volume, which reflects the greatest credit upon the Committee, the printers, and, above all, the Editor, Lt.-Col. W. A. J. O'Meara, C.M.G., R.E. (ret.), who undertook a Herculean task in collecting, verifying, sifting, and editing the enormous mass of material involved in the preparation of the biographical records of the fallen members. Excellent portraits are reproduced, and the records of war service are so detailed as to constitute valuable historical essays. Amongst them we find many names familiar to electrical men through their distinguished fathers, and not a few who had themselves attained distinction in civil life, before they crowned their careers by the supreme sacrifice. The Roll is indeed a fitting memorial of great souls, and will be treasured by those "to whom sorrow comes in so glorious a shape."

The Electric Vehicle Load.

We are constantly drawing attention to the great importance of the domestic load and the need for the suppliers of electricity to do all in their power to bring the public to realise the value of electricity in the home. The fact that we are behind many other countries in this respect has been repeated *ad nauseam*, but we have been reminded as the outcome of our recent leading article on "Popular Electrical Enterprise" of one of the departments in which we in this country stand at so backward a stage in comparison with our cousins across the Atlantic—namely, the electric vehicle. The position was described very forcibly by Mr. C. Holmes Waghorn, A.M.Inst.C.E., in a paper on "Laundry Transport Problems," which he read recently before the London Section of the National Federation of Launderers. Mr. Waghorn pointed out that, although the price of petrol is lower and the cost of electricity in the United States is higher than in Great Britain, the use of the "electric" is widespread and increasing. It is stated that there are over 40,000 electric vehicles employed in the United States, about 25,000 of them being commercial vehicles. This superiority of America, in spite of less favourable conditions than those prevailing here, is attributed by Mr. Waghorn to the enterprise of the electricity suppliers who do all in their power to develop this important load. There is no doubt that the charging of vehicle batteries can be a great aid in the straightening-out of the load curve. After their day's work electric vehicles are idle for many hours, and they could conveniently be put on charge as the lighting load went off and be ready in good time for their next day, having helped to fill in the night "valley." It will be seen, then, that the chief virtue of this load is its convenience; it can usually be taken on without any thought of increased generating plant. The chief trouble seems to be the existing lack of charging facilities. If, however, engineers could see that the load was worth encouraging and likely to grow, they would not hesitate to put in the necessary motor-generator plant.

Subject to this, there is much point in Mr. Waghorn's dictum that "Supply companies who urge consumers to adopt electric toasters, flat-irons, and radiators, and ignore the electric vehicle, are neglecting an opportunity of selling thousands of kilowatt-hours of off-peak current per year."

Private Automatic Branch Exchanges.

Some Features of Small Automatic Telephone Exchanges rented from the Post Office.

By A. B. EASON, M.A., A.M.I.E.E.

A Private Automatic Branch Exchange (PABX) is a telephone installation upon a subscriber's premises (1) with all or some of the extensions connected to automatic telephone apparatus, so that telephone calls from extension to extension are completed automatically, and (2) with a manual switchboard and an operator to deal with traffic from and to the public exchange.

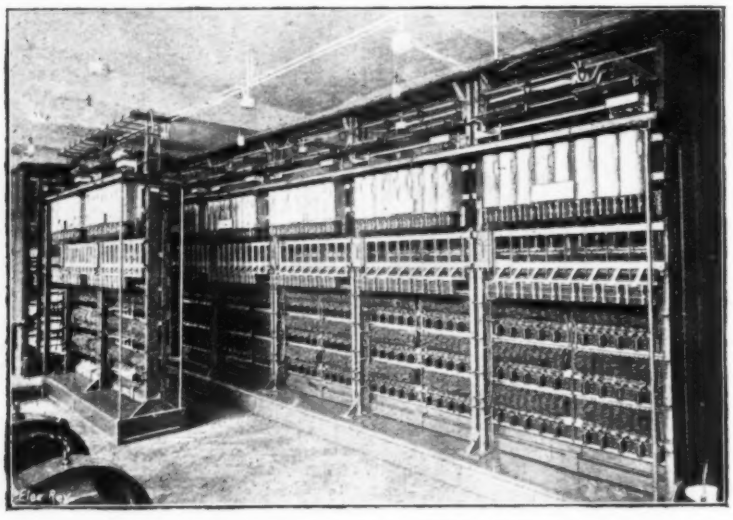


Fig. 1.—Line Switchboard Units—Final Selector Side, at a 600-line P.A.B.X., on the Automatic Telephone Co.'s System.

A Private Automatic Exchange (PAX) is one where there is no connection with a public exchange.

For some years the telephone companies have been installing private automatic exchanges for various firms in the British Isles and elsewhere, especially in America. Now in London there are also about 30 PABXs, which are introducing the public to the advantages and features of automatic telephony, so that when automatic public exchanges are opened in London within the next few years, many subscribers will be prepared to manipulate the dial in order to call up the people they want.

Before considering the traffic features and operating methods of PABXs, the writer will give some idea of their size. The figures must be taken with a little latitude, for statements which are correct at the time of writing may be slightly altered before printing, and may be altered again before publication, owing to rapid development and changes which occur almost daily. In general, the size of exchanges varies from PABXs with 20 automatic extensions and one operator at the manual board which communicates with the public exchange, up to those having 600 lines and eight operators at the manual board. The Post Office official exchange is not included, as it is an old exchange and is more on the lines of a public exchange than on the present PABX lines. The PABXs working and on order in January, 1925, included approximately 70 up to 70-line capacity; 20 from 71 to 200-line capacity, and the following large installations: three of 400 lines, one of 650 lines, and a multi-office with 730 lines scattered among six exchanges. The value of the automatic switching plant, exclusive of the telephones and instrument wiring in these installations, is now well over £100,000.

The relatively large amount of electric power used for driving the automatic switches and for supplying the current to the telephones for speaking purposes is provided by accumulators placed in the same building as the PABX installation. Plant for charging these accumulators is also provided locally. This procedure differs from the method adopted in manual PBXs for providing power to the telephones, where the total amount of power is so small that it is supplied from the public exchange over power leads to the PBX. There are a few existing manual PBXs, such as those at Harrod's and the War Office, where the number of extensions is so great that the exchange installed is similar to a public exchange, and accumulators and power plant are provided on the premises. Power plant deserves mention because it has not always been easy to find suitable accommodation for it in the building where the PABX is installed.

Advantages and Operation.

The writer will now deal with some advantages and traffic features of PABXs, and with the methods of handling various types of calls, in the case of those exchanges which comprise both automatic and manual plant.

The one great advantage of the automatic type of plant is the speed of disconnection after an automatic call has been made and is finished; by "automatic" call is meant one from one automatic instrument to another automatic instrument. In such a case, when the calling party hangs up the receiver, his telephone is immediately ready to receive another call. With a PABX it is a common occurrence to hang up the telephone receiver and to hear the bell

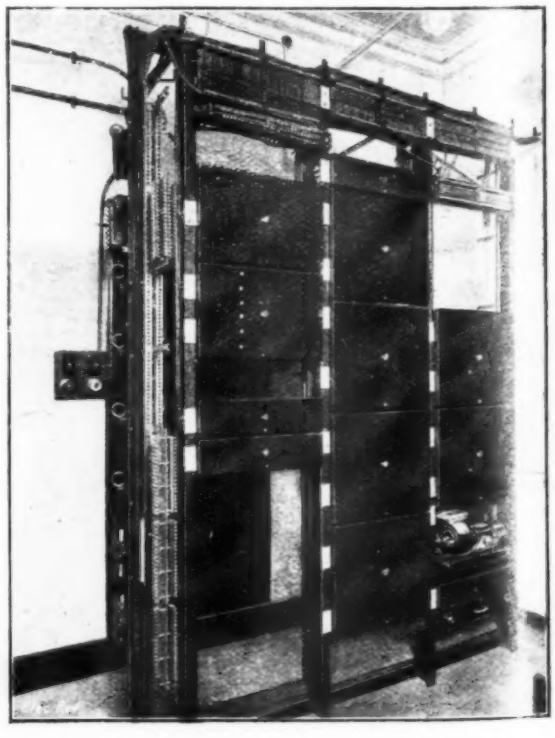


Fig. 2.—A 60-line "Relay" P.A.B.X. installed in the Offices of the "Glasgow Herald."

ring within half a second, almost before one has removed one's hand from the telephone. Such an

occurence can never happen with manually worked PBXs, because no matter how fast an operator can work, there must be a time element over a second to allow her to see the clearing signal and then to set to work to pull the plugs out. Normally, the operator is busy with making connections, and allows the disconnection of the circuit to wait a few seconds until any calling signals have been answered.

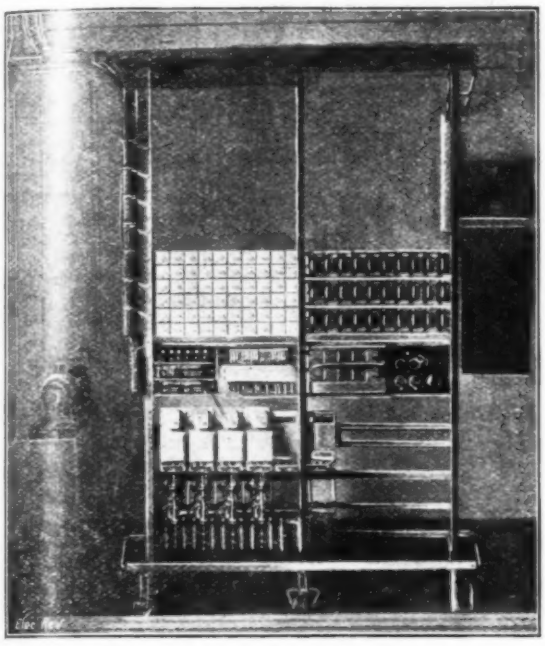


Fig. 3.—A Siemens Installation at Cheadle Royal Mental Hospital.

The amount of advantage to be obtained by automatic switching will depend upon what sort of service one's existing manual operator has been giving. Sometimes the operator is a very quick one, and the difference when automatic working is introduced is not so very marked; but if the operating has been slack, the difference is very apparent.

The second advantage of automatic gear is the continuous day and night service which is given for local calls—that is, from extension to extension. This advantage will depend upon the type of business, and whether there is much communication to be done when there is no suitable person to work the manual board. Night service cannot be given on small manually worked PBXs, and may be a useful feature where a few members of the staff are working late and wish to communicate with each other; such service is readily given by automatic installations.

There are other advantages obtainable with automatic working, but these two are the pre-eminent ones.

On all PABXs it has been found necessary to provide a manual operator to control inward calls, *i.e.*, calls from the public exchange to the members of the business firm concerned. The PABX operator distributes the calls to the proper person to answer the inquiry; the incoming call must be put through to the right person, and only the local PABX operator possesses the requisite knowledge. It is only occasionally that the caller will know the telephone extension number of the person required.

When dealing with outward calls, *i.e.*, from an extension to the public exchange, matters are quite different; ordinarily the person at the extension telephone dials "O," and this will light a calling signal either (*a*) at the local manual PABX board, where it is answered by the local operator, or (*b*) at the public exchange, where the public exchange operator will answer the call just as if it came from an ordinary subscriber.

Considering case (*a*), which at present is the most common, the person at the local extension tells the PABX operator what number or what firm is wanted, and can then hang up his receiver and wait for the local operator to get the number *via* the public exchange; the operator rings the extension when the person required has been obtained. This is satisfactory for the official of the firm, as he can go on with his work without waiting on the 'phone till the connection is made. In case (*b*), the person at the local extension, having dialled "O," waits for the public exchange operator to answer, and then gives the number required and waits till the called subscriber answers. In case (*a*), the local PABX operator can record the calls which are made outward, and can thus check the account which is sent in later by the Post Office; in case (*b*), the firm has no method of controlling outward calls. The relative merits of these two methods of working must be weighed up by the renters when they are desirous of installing a system.

In the case of a small installation, there is not much gained by dialling direct, as the operator must be provided in any case for dealing with inward calls, but when the installation is large, the time of one operator may be saved by allowing the extension to dial "O" and get the public exchange directly. When the public exchange becomes automatic, there will be the further advantage that calls made to one's own automatic exchange will be able to be completed entirely automatically.

In case (*b*), if the local extension wishes to speak to the PABX operator to make an inquiry, it is usual to allot some other number, say, 9, or 91 for the purpose. This number is dialled also when the local extension wants to make a *trunk* call, as the demand must be passed to the public exchange, and when the call matures it must be put through to the extension which asked for it; the local PABX operator must have the record of the demand. If the local extension in mistake dialled "O" and asked for the trunk call, the public exchange operator would request the caller to pass the call again through his own PABX board.

Special Cases.

In certain cases, such as the London County Council and others, it has been found desirable to have some

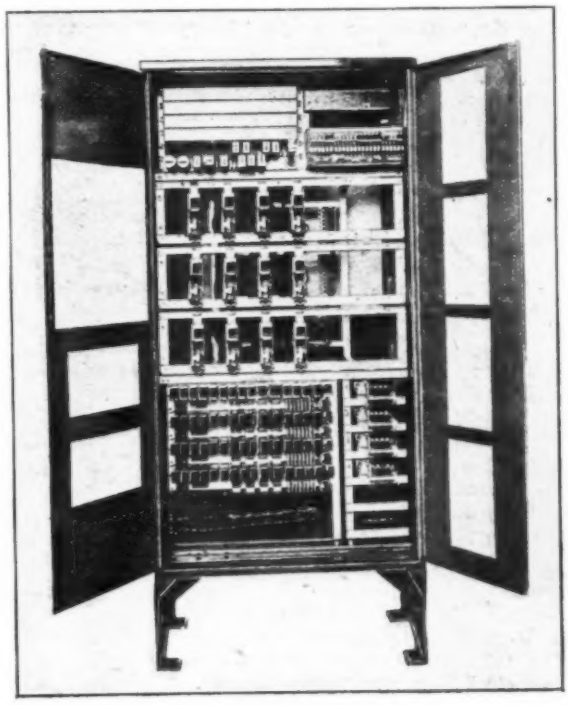


Fig. 4.—Western Electric P.A.B.X.

purely *manual extensions* on the system; calls from these extensions are made by lifting the receiver just as in the case of a C.B. manual exchange, and the operator completes the required connection. The feature is of use to the L.C.C. as it allows members of the public who are councillors to make calls in the same way as they are used to making them on their

own public exchange. These councillors are not used to manipulating the dial of the automatic instrument. The same principle has been adopted for some coin box telephones in a large stores, where the public who come to make calls would get no advantage by dialling, as all the calls have to go through the manual board PABX operator.

In many installations there are *tie lines*, which are lines connecting the PABX with other PBX switchboards of the firm; in the earlier cases these tie lines appeared on the manual board, and were worked manually just as if they had been exchange lines, and had no direct connection with the automatic plant. In some newer installations these tie lines terminate upon the automatic plant, and the distant PBX can dial and obtain access to the automatic extension required without the intervention of an operator. This is obviously of advantage, as it sends the calls through entirely automatically. In one case where there are two PABXs at a distance from each other, the tie lines are worked automatically both ways, and the extensions at either end can ring up the extensions at the other end.

In the case of the Port of London Authority's PABX, the tie lines which connect the various exchanges will be worked both manually and automatically; that is, the operators when putting calls through from the public to the extensions at the various Port of London exchanges will use the same channels as will be used by calls going automatically from exchange to exchange.

To work one tie line both automatically and manually has the disadvantage that the operator takes a few seconds to clear, and the advantage of immediate release in automatic working is to some extent lost. It is better to let the operators at both ends control the working and put calls through in succession as they are required, rather than to have two operators and extensions at both ends of the line, all trying to obtain possession of the tie line when it is idle.

Code Calls.

In some big works it has been found desirable to install a system whereby the factory manager or any of the principals who may be in the works can be summoned to a telephone by giving a type of code ring on a bell. This facility can be given by mechanism quite apart from the ordinary automatic plant by providing large call bells in prominent places; the PABX operator gives a particular type of ring by pressing a key which will ring all the call bells. The manager or principal who is wanted will recognise his ring, and goes to the nearest automatic telephone, from which he rings up the operator and is put through to the caller. The means for giving the code rings is not part of the ordinary standard equipment of a PABX; but the ringing should be under the control of the PABX operator, who receives the call for the manager.

Different Systems of PABXs.

The systems installed by the Post Office may be classified thus:—

Automatic Telephone Manufacturing Company's
- (*a*) Keith line switch, 50 volts.
- (*b*) Rotary preselector, 50 volts.
- (*c*) Line finder system, 50 volts.

Relay Automatic Company's
- (*d*) Multiple type board, 32 volts.
- (*e*) Non-multiple board, 24 volts.

Siemens Brothers, Ltd.
- (*f*) Preselector system, 60 volts.

Western Electric Company's
- (*g*) Rotary system, 48 volts.
- (*h*) Line finder system, 36 volts.

Systems (*a*) and (*g*) are now obsolescent so far as this country is concerned; no new installations of those types will be installed. All the other systems at the moment seem to be working about equally well, that is to say, up to now no consistent superiority appears to be inherent in any of the systems which warrants its being made an absolute standard to the exclusion of all the others.

There is no definite relation between the size of manual boards and the size of automatic plant in PABXs; the variations being very great in this matter, it may be worth while to point out their nature.

The most common installation consists of one manual position for the PABX operator and automatic plant for from 30 to 50 lines. As the lines increase to more than 100, then in many cases a second manual position has been found to be necessary. The Post Office has also arranged for the installation of boards such as these:—

- 3 positions and 100 lines,
- 3 positions and 60 lines,
- 4 positions and 60 lines,
- 5 positions and 400 lines,
- 4 positions and 400 lines,
- 8 positions and 200 lines; the positions also dealing with the traffic from 5 other exchanges,
- 1 position and multi-exchange system, with one exchange of 10 lines, one of 20 lines, and one of 40 lines.

Time Required to Erect Installations.

The Post Office Department does not manufacture PABXs at present, but purchases them from the telephone contractors; owing to the rapid development of automatic telephony, and to the many different conditions which have had to be met in different installations, it has not yet been possible to have ready at a moment's notice a complete automatic exchange with batteries and power plant when a subscriber signs the agreement. At the time of writing, January, 1925, the delivery time offered for 50- to 100-line boards with one manual switchboard has often been about five months, though occasionally delivery in three months may be possible, reckoned from the date of giving the order to the telephone contractor to proceed with the manufacture. For large PABXs which are similar to public exchanges, *i.e.*, with 4 or 5 positions and 400 lines, deliveries run into 9 and 12 months. In one particular case plant for 30 lines was required, and the contractor could only offer to deliver it after a year. The reason is that telephone development is increasing rapidly, and while the factory output of apparatus is increasing, it has not yet been able to catch up the leeway which occurred through arrested development during the war.

The Exportation of Power from Canada.—The Dominion Government has decided to levy a tax of 0.03 cent. per kWh upon all power "exported" from Canada. While the *Electrical World* considers that this will mean an increase of rates to the American consumer, the *Electrical News* (Toronto) takes the view that it is doubtful if Canadian power producers can raise their charges to customers under the existing contracts.

In the debate upon the Budget, in which the new tax is embodied, Sir Henry Drayton, formerly Minister of Finance, said that he was absolutely opposed to the exportation of power to the United States, as all the power produced in Canada could be profitably employed in the Dominion. The charge for power in Canada was only a fraction of the price of power in the United States, and the tax would not prevent the exportation of power to any extent. He was afraid that the Government was preparing the way for an excuse which would enable it to consent to the export of power in large quantities.

Power is exported to the United States from Ontario, Quebec, New Brunswick, and British Columbia. The largest exporter is the Cedar Rapids Manufacturing & Power Co. (a subsidiary of the Montreal Light, Heat, and Power Consolidated), which last year sold over 425 million kWh to American customers. Three other large power companies together exported over 900 million kWh during 1924, while several other concerns have important export contracts.

A later issue of the *Electrical World* states that, in the view of authorities in the Province of Manitoba, the tax will retard hydro-electric development, and the Government of the Province has protested against the proposed duty. The opinion has been expressed that the Dominion Government would be acting *ultra vires* if it endeavoured to make the exportation of power prohibitive by means of a tax, as such a matter is entirely the affair of the provincial governments.

Telephotography.—A new use for the system of sending pictures long distances "over the telephone wires" has been found, says *The Times*. An X-ray photograph of an injured human hand was transmitted from New York to Chicago for a surgeon's diagnosis. The sending of the photograph was completed in seven minutes. Röntgen-ray operators in New York hospitals who have been making experiments with these "telephoned" pictures, state that they are apt to lose about 25 per cent. in definition, but are still useful for diagnosis.

The I.E.C. and International Standardisation.

The Basis of Fair Competition.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

(*Concluded from page* 689.)

Regulations for Overhead Transmission Lines

Considerable discussion arose as to whether or not the I.E.C. should limit itself to the publication of the comparison of the rules of the different countries. Mr. A. Page (Electricity Commissioner) acted as spokesman for the British Committee, which advocated the issue of definite recommendations. Criticism is often made to the effect that the official regulations are too severe. Now, if there were standard I.E.C. rules, such criticism could be met. The objection on the part of some nationalities was evidently due to the fear that they would have to raise their standards if I.E.C. regulations existed, and thus the cost might become prohibitive. It was suggested that what was required was a minimum basis and not necessarily a model one, the minimum requirements being based upon (*a*) safety, (*b*) maintenance of continuity of service (according to the class of service) and (*c*) cost. As regards continuity of service there must obviously be two classes of construction: (i) for an uninterrupted service to cities and towns; and (ii) for a service to villages and rural districts, in which an occasionally interrupted service would be the penalty for the much lower cost of construction. This put the matter in a new light and it was decided to ask the various National Committees to prepare recommendations.

Standard Low Voltages.

This subject gave rise to a heated discussion. The proposal was to adopt 220 volts. To this the British and the Americans declined to agree. Eventually two voltages were decided upon as a compromise, *viz.*, 220 and 230, which still did not give satisfaction. Finally, however, a series was selected which meant that these figures, or these figures multiplied *or* divided by 2 *or* $\sqrt{3}$, were accepted, *i.e.*:—

Direct Current.	Single Phase.	Three Phase.
1×110 or 1×115	1×110 or 1×115	110 or 115
2×110 or 2×115	2×110 or 2×115	127 or 133
4×110 or 4×115	1×220 or 1×230	220 or 230
1×220 or 1×230		between phase
2×220 or 2×230		and neutral.
1×440 or 1×460		

Lampholders.

In accordance with suggestions made at the Geneva I.E.C. Conference, the manufacturers have appointed a committee, which reported excellent progress. Directly the manufacturers' technical committee has agreed upon the trade standards, they will be brought before the I.E.C. for confirmation. This the manufacturers have agreed to do within a period of twelve months. The manufacturers have also been asked to consider bayonet socket holders. For these British and French specifications are already in existence, which compare closely with each other. In view of the number of accidents that have occurred in using the Edison type socket (there were five fatal ones in the Netherlands last year), the manufacturers have been asked to give particular attention to the question of insulation.

Front row (left to right): Messrs. Girault (France); S. Artigas (Spain); E. Huber (Switzerland); Brylinski (France); Dr. C. O. Mailloux (United States, Hon. Pres. I.E.C.); G. Semenza (Italy, Pres. I.E.C.); Stieltjes, Prof. Feldmann, Tromp (Holland); C. le Maistre (Gen. Sec.); B. Lyon, R.A. Van Sandick (Holland); Dr. C. Sharp (United States); M. Dupres (Canada).
British delegates and guests: Messrs. A. R. Everest, S. A. Stigant, Dr. A. Michie, Lee, Kewley, C. Rodgers, R. B. Matthews, V. de Ferranti, Cook, Wallis, G. A. Juhlin, Batt, Lt.-Col. F. C. Leigh, Marshall, P. Good.

The Delegates at The Hague Conference of the I.E.C., 1925.

Standard High-pressure Voltages.

The following were put forward on behalf of the British Committee: 3, 6, 10, 30, 45, 60, 100 and 200 thousand volts, the reason for the selection of 45,000 being the present practical limit for underground cable transmission. To this list were added, after some argument, 1, 2, 15, 20, 150 and 300 thousand, the voltages to be those at the point of delivery. It was also suggested that though this somewhat lengthy list might be necessary at present, it would be well for the I.E.C. to recommend the standards that it would

advocate for new installations independent of existing ones. This it was decided to do in time for the next conference.

Prime Movers for Electrical Plant.

One of the points the British National Committee desired, was to include British units. This, of course, did not appeal to the metric countries; however, by a compromise, all the units, including the British, were included in an appendix. The British Committee made a little *faux pas* by describing "total head," also as "the total energy per unit mass." This gave the professorial element their opportunity—accordingly the phrase was deleted. An interesting point arose in that in France there are two distinct terms which cover the English one of "internal combustion" engine, *viz.*, "explosion" engines (*i.e.*, gas and petrol) and "high pressure" (*i.e.*, Diesel type) engines. The nomenclature of hydraulic and steam turbines was next dealt with, the object being to compile two documents, which could be attached to tenders, each to contain all the definitions required for each tender. Thus no misunderstanding could arise between the manufacturer and the purchaser. Further, the comparison of tenders upon an equal basis would be ensured.

Transformer Oils.

This was perhaps one of the most important subjects discussed at the conference from the strictly scientific point of view. It was one upon which there was very considerable divergence of scientific opinion. Expert papers were read by Prof. Gault (France), Dr. A. Michie (Great Britain), Prof. de Haas and Mr. Couvée (Netherlands), and Mr. G. Faccioli (United States). Three dealt with the sludge question and one with the flashpoint. Eventually it was decided to appoint a sub-committee to make suggestions and report at once. At the afternoon session this sub-committee suggested that three experts (Messrs. Snyder, Gault and Michie) should be asked to co-ordinate the existing known methods of testing transformer oils (which seem to be extremely varied), keeping in touch for that purpose with all countries which were doing similar work.

The Committee of Action,

or, as it might be otherwise termed, the Executive Committee, met at the conclusion of the conference, as is the usual practice, to consider all the points approved by the various sections. Upon this committee rests the responsibility of confirming, or otherwise, the various decisions. If finally approved, they are referred to the various National Committees for their official sanction, for which a period of six months is allowed, after which the decisions become the official decisions of the I.E.C.

This Committee consists of the President, the Honorary Secretary, and three Presidents of National Committees. No substitutes are accepted.

Matters of general policy are also discussed by this Committee. An important matter was that of finance. Owing to a judicious expenditure upon printing for this particular conference, all the delegates came better prepared, hence it is not to be wondered at that more work was accomplished than at any previous meetings. A balance sheet was published which showed that all countries were not quite contributing their fair share of the cost—especially those, it may be remarked, which were most critical of the procedure and as to who should be invited to attend the I.E.C. conferences. Recent additions are the Dutch and Czecho-Slovakian Committees. The re-instatement of the German Committee was very carefully discussed, but it was found to be impracticable to arrive at a definite decision, though it is hoped to do so before the next conference. The main difficulty seems to be to differentiate effectively between the political and commercial aspects. Still some half-dozen written comments from the German standardisation authorities were considered at this meeting, which is a step in the right direction, as, after all, it is most important that separate standards should not be set up by that country, for it would only make the confusion of competition worse confounded. It is proposed to hold the next conference within about six months, say, at the beginning of November. Invitations have been received from the Americans and from the Swedes. Owing to strong pressure from the former, backed by good reasons, their invitation seems likely to be accepted.

Visits to Works.

As is usual on the occasion of an engineering conference, the opportunity was taken of visiting undertakings of engineering importance in the neighbourhood. While very little of this was done at The Hague, the one day that was devoted to it proved very interesting. The party was driven in motor vehicles through a part of the 12,000 acres which are devoted to bulb growing in Holland. The large masses of brilliant colour produced by hyacinths, daffodils and narcissus, provided a wonderful sight. It was a couple of weeks too early for the tulips. A visit was paid to the Haarlemmermeer Polder, where there is still at work one of the quaint Cornish steam engines made by Fox & Co. of that county, to the designs, also, of English engineers—Arthur Dean and Joseph Gibbs—in the year 1839. A polder is land below sea-level, which has to be kept pumped, to keep it free of water. It was interesting to note that in this particular polder of about 20 square miles, practically every farmhouse and cottage had its supply of electricity. In fact, the Cornish steam engine will not have a very much longer lease of life, for most of the steam engines and windmills are being replaced by electric motors. The party then proceeded to the ship canal which connects Amsterdam with the North Sea, where a giant swing bridge, with two railway tracks, was shown in operation. It was of the balanced type, and though it weighed some 1,400 tons, it was opened wide by a 30-h.p. electric motor in 63 seconds. As most people are aware, a great dyke is being constructed to shut off the Zuider Zee from the sea. Four big polders will be formed in this way, with a large sump in the centre, to collect the waters of the Yssel and other rivers, ready for pumping away.

A wonderful engineering work is in progress at Ijmuiden, the entrance of the Amsterdam canal. A new lock is under construction which will be the largest in the world. It will take a 100,000-ton ship (the largest afloat at present is of 50,000 tons). Its length is 1,300 feet, width 162 feet, and depth over the sill 49 feet. The work was commenced in 1920 and is now about half done. Ten million cubic yards of material have already been excavated and another seven million cubic yards have yet to be removed. With due Dutch attention to economy, the excavated material is used, chiefly at Amsterdam, to form building sites for houses. Considerable trouble has been occasioned by springs and a good deal of electric pumping has to be done to take away the water. This water incidentally is used for general industrial and domestic purposes as a water supply, so even this water is not wasted. A notable feature of the concrete mixers, gantry cranes, and other machinery used was that it was practically all electrically operated—which compares favourably with the practice of an English contractor, who generally seems to favour steam. The main distribution of the current was by armoured cables, supported by rough ladders in descending the lock walls and then buried a few inches under the surface. The smaller pumps were supplied by overhead lines of very crude and simple construction. It made one wonder what were the thoughts of some of the eminent experts on overhead transmission, who were present.

As a Dutch engineer remarked, it seems better to give men employment upon such an important national engineering work as this, than to allow a state of idleness and doles.

Building Exhibition at Birmingham.—A Building and Allied Trades Exhibition, organised by the Birmingham Chamber of Commerce, will be held at Bingley Hall, Birmingham, from September 7th to 19th. The object is to stimulate interest in matters relating to house building, town-planning and road construction, &c. The schedule includes a section devoted to electrical plant and fittings. The movement has the support of the Electrical Contractors' Association.

Series Motors and the Hopkinson Test.

By H. COTTON, M.B.E., M.Sc., A.M.I.E.E.

If two coupled series motors are connected in series, and arranged so that they tend to run in opposite directions when motoring, then any load can be placed on them by adjusting a diverter connected across one of the fields. When testing shunt machines it is usual to have the armatures connected in parallel, although this is not essential, and the motoring machine is that which has the smaller excitation. With series motors connected in series, the two armatures carry the same current, and the torques developed are in consequence dependent on the fluxes. Since the machine which is to act as a motor must develop the greater torque, it must have the greater flux, and the generating machine

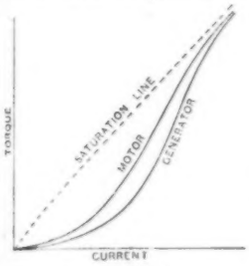


Fig. 1.

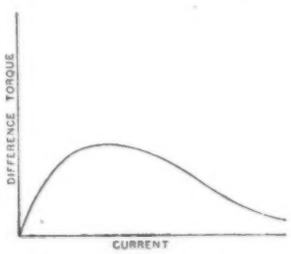


Fig. 2.

must have the reduced excitation. Hence the diverter is connected across the generator field. The applied p.d. must be equal to the difference between the motor and generator induced e.m.f.'s, plus the sum of the ohmic drops in the two machines. Since this varies with the load, a battery with regulating cells is convenient.

It is commonly assumed that a test on the above lines can be successfully carried out, but in practice the set is found to be very unstable. As the reason for this instability is not by any means obvious, the following investigation was carried out. The machines used were two identical 1-h.p., 200-V motors, with a full-load speed of 1,000 r.p.m. Although larger motors were available, it was decided to use these small machines because, as was pointed out by Drysdale (*Electrician*, 1910, p. 322), small motors provide the most searching test of the accuracy of a regenerative method. The

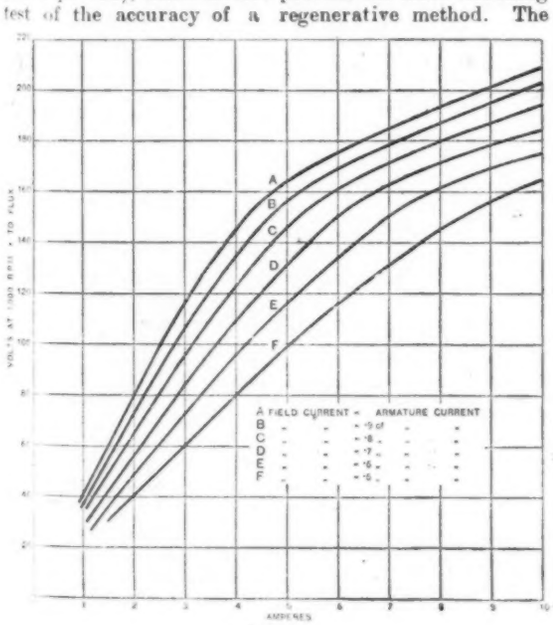


Fig. 3.

generating machine has to have its excitation weakened, and its flux is therefore less than that of the motoring machine so long as the iron is not saturated. When the current is so large that saturation is reached, the fluxes in the two machines will be very nearly the same. The torque is proportional to the product of flux and current, hence the torque-current curves for each machine will have the shape shown in fig. 1, each curve approaching the saturation line asymptotically. Now the torque due to the losses produced by rotation of the armatures, namely, iron losses and friction and windage, is overcome by the difference between the motor and generator torques, and obviously for stable running at any given speed the set will work at such a point on the curves that this difference is equal to the friction and iron loss torque corresponding to the speed. The difference torque when plotted against current will give a curve of the shape shown in fig. 2. It will reach a maximum and then slowly decrease.

The experimental results are given in figs. 3, 4, and 5. The magnetisation characteristic A was obtained by driving one machine at a constant speed of 1,000 r.p.m., separately exciting the field, varying the excitation, and reading the voltage induced in the armature. The curve B, which corresponds to the generator flux at the same speed, when the field is shunted by a diverter which allows 0.9 of the total current to pass through the field, is derived from A as follows:—

In order that the generator flux may be equal to the motor flux corresponding to any point on curve A, the total generator current must be equal to the corre-

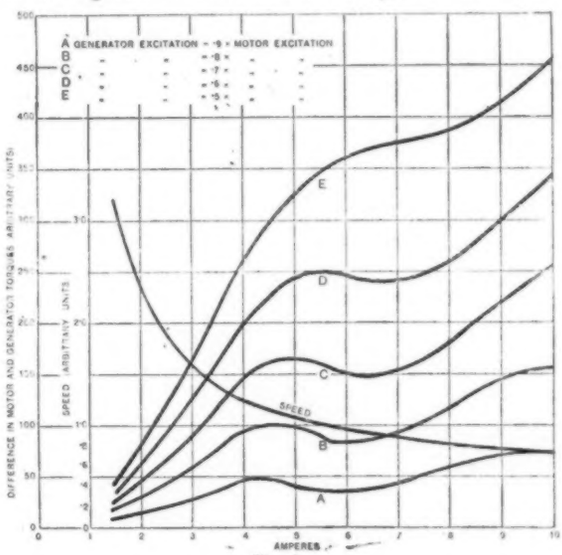

A GENERATOR EXCITATION = 1 × MOTOR EXCITATION
B " " = .8 × " "
C " " = .7 × " "
D " " = .6 × " "
E " " = .5 × " "
DIFFERENCE IN MOTOR AND GENERATOR TORQUES ARBITRARY UNITS
SPEED ARBITRARY UNITS
SPEED
AMPERES

Fig. 4.

sponding motor current divided by 0.9, that is, 1.11 of the motor current. Hence, to obtain points on curve B, ordinates equal to those on curve A are erected at abscissæ equal to 1.11 times the corresponding abscissæ on curve A. The curves C, D, &c., which correspond to the generator field carrying 0.8, 0.7, &c., of the total current are obtained in the same way. The corresponding torque curves are obtained by multiplying the flux by the current, and the curves giving the differences between the motor and generator torques are obtained by deducting the ordinates of each of the torque curves calculated from curves B, C, &c., in fig. 3 from the torque curve calculated from curve A. These curves of difference torque are plotted against current in fig. 4, and it will be seen that they are not so simple in form as figs. 1 and 2 would lead one to expect. The final increase in the difference torque is due to the fact that the magnetisation curves for the different settings of the diverter approach one another so slowly after saturation is nearly reached that their difference decreases at a rate slower than the increase in current.

In fig. 5 a speed curve is drawn, the speed being derived as follows:—The speed of a motor is propor-

tional to the armature back e.m.f. and inversely proportional to the flux. For any armature current the back e.m.f. is equal to the applied e.m.f., less the ohmic drop in the armature. Usually this ohmic drop can be neglected unless the machine is a very small one. The motoring machine has its full excitation, hence its flux is given by curve A of fig. 3, and the speed of the set is thus proportional to the back e.m.f. divided by the corresponding ordinate of curve A. In the next set of curves, fig. 5, the differences in torque for the various settings of the diverter are plotted against the corresponding speeds, and it will be seen that a family of curves very similar in appearance to a set of Van der Waals gas curves is obtained. For stable running at any speed the curve giving the torque of iron and friction losses must cut the curve of driving torque, that is, the difference torque, at that speed. Now, the former curve is smooth, and it is therefore possible for it to cut the resultant torque curve (*a*) not at all (*b*) at two or three points (*c*) to be tangential at a maximum or minimum. It will also be noticed that the greatest irregularities occur within the range of speed corresponding to the normal working range of the motor, although, of course, this may not happen in every case.

It is now necessary to derive the shape of the curve of iron and friction losses. This can be done analytically, but the direct experimental determination is obviously the most satisfactory. A load test was first performed on one machine in order to determine the variation of speed with load currents. The two ma-

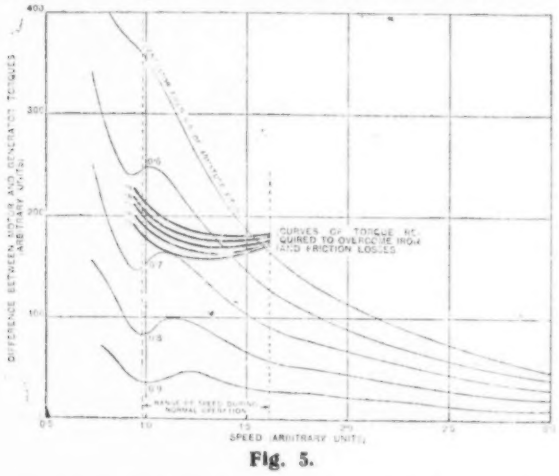


Fig. 5.

chines were then coupled, the motor excitation was given a series of values, and sufficient voltage was applied to the armature to give the normal speed as determined from the result of the load test; at the same time, the generator excitation was adjusted to .9, .8, &c., of the motor field. The generator armature was on open circuit, and therefore the intake of the motor armature, less armature copper loss, gave the total iron and friction loss. This loss divided by the speed finally gave the curve of iron and friction-loss torque.

The results of this test are plotted along with the derived difference torque curves in fig. 5. It will be seen that there is little variation in the iron and friction-loss torque, so that it is possible for the curves to cut the derived curves in any of the above ways. It will also be seen that the family of experimentally determined curves is arranged in the reverse order to the curves of difference torque as derived from the magnetisation characteristics. Hence, if the set, when loaded for the Hopkinson test, could run with stability for one particular setting of the diverter, say .7, then with a higher setting, say .9, the torque developed would not be sufficient to overcome the new core losses, while with the lower setting, say .5, the torque developed would be greater than necessary. The result of this is that, when carrying out the test, there is a slow creep of the speed either up or down according to whether a position of definite stability for the setting of the diverter and the applied p.d. requires an increase or decrease in speed.

Wireless Measurements during the Solar Eclipse.

By R. L. SMITH-ROSE, Ph.D., M.Sc., A.M.I.E.E.

On page 390 of the issue of the ELECTRICAL REVIEW for March 6th appears an article by Mr. Arthur E. Cotterell, entitled "Wireless and the Solar Eclipse." This deals in a critical manner with the possible effect of the solar eclipse of Saturday, January 24th last, on transatlantic wireless communication and particularly with the report of some measurements made during the eclipse by a group of workers in this country, this report having been published on p. 214 of the ELECTRICAL REVIEW for February 6th. The writer of this report would like to make a few comments on Mr. Cotterell's article, in the early part of which it is stated that in wireless transmission the observed differences between day and night, and between summer and winter, conditions are explained as resulting from the ionisation of the earth's atmosphere by solar rays. To avoid being drawn into a discussion, the validity of this quite general explanation will not be questioned here. What is not admitted, however, is that complete shielding from the sun's radiation, whether by its normal daily setting or by an eclipse, is necessary for the phenomena commonly known as night effects in wireless transmission to be observable on the earth's surface. There is now abundant evidence showing that, under certain conditions, these "night" effects may begin in daylight one or two, and even on occasions four hours, before sunset. The phenomena appear to be connected in some way with the intensity of the solar radiation in certain portions of the earth's atmosphere.

Reverting to the article in question, details are next given as to the dimensions of the umbra and penumbra caused by the eclipse, and of the distance of the umbra from the great circle path from America to Great Britain; and it is then deduced that no important effect could take place. It is, in fact, stated ". . . . that any expectation of improved transmission between America and England could have been based only on some oversight of the actual conditions relating to the eclipse." It is doubtful if any of the most prominent wireless experts in the world would have been prepared to prophesy, as apparently Mr. Cotterell would have been, that no effects would be observed, and that it was therefore a waste of time and money to carry out such experiments. It must be stated here that while full details of the eclipse were previously known to all those responsible on both sides of the Atlantic, the experiments were carried out with the only attitude possible in a scientific investigation, *viz.*, a perfectly open mind. It is further submitted that in spite of Mr. Cotterell's deductions, effects *were observed and measured* on the day of the eclipse which did not take place on either the preceding or the succeeding day, and are not a usual daily occurrence in transatlantic communication; and that it is therefore logical to attribute these effects, directly or indirectly, to the solar eclipse.

Adequate knowledge of the strength of signals from the Rocky Point transmitting station at all times of the day and night has been obtained from weekly measurements which have been carried out at three stations in this country for a period of more than one year immediately prior to the eclipse.

In addition to the curves accompanying the published report in the ELECTRICAL REVIEW of February 6th, two further sets of curves were obtained, showing observations of signal strength from the Rocky Point transmitting station as measured at a second station at Chedzoy, Somerset, and also at a station at New Southgate, London. Although all these curves were sent to the Editor with the report, time and space precluded their publication. The results obtained at London are shown in fig. 2 on page 152 of the *Electrician* for February 6th last. There were thus four independent observers in Great Britain separated by extreme distances of over four hundred miles, making simultaneous measurements of the transmission from a single station

and using three quite different methods of measurement. After making the most liberal allowances for the variations in all curves of a few per cent., which may or may not be experimental errors in the systems of measurement employed, it is surely significant that on the day of the eclipse only, all four stations produced a curve of a characteristic shape, which predominates to a most marked extent over the other variations recorded. This characteristic shape takes the form of a rise in signal strength to a maximum value, representing an increase of from 125 per cent. to 150 per cent. of the mean value during the previous hour, this maximum being succeeded by a very rapid fall to a minimum which, lasting only a few minutes at each station, was followed by a return to the usual daily conditions. The coincidence between the occurrence of these minima and the passage of the path of totality across the great circles through transmitting and receiving stations was pointed out in the report.

The writer has his own ideas as to a possible explanation of this experimentally-observed phenomenon, but he also possesses sufficient experience not to divulge them without further confirmation, even though an opportunity for this may not be presented until the eclipse of 1927.

The limitation of the duration of the measurements on the three days is fully realised, but it must be remembered that the organisation of the experiments under discussion involved the entire suspension of the daily traffic passing through one of the world's largest wireless transmitting stations. From a scientific investigation point of view we should be grateful to find that commercial organisations were sufficiently broadminded to suffer the inconvenience and not inconsiderable expense, which was involved in the carrying out of such experiments, a proceeding which apparently Mr. Cotterell would have previously condemned as unjustifiable.

France's Foreign Electrical Trade.

In the last monthly return prepared by the French customs authorities, appear figures relating to the imports and exports for the whole of the past year. We reproduce below such of these statistics as apply to electrical goods and with them give the previous year's totals and the difference between the two sets of figures. In the case of exports the valuations given are those of the French Customs Commission.

IMPORTS.

	1923. Thous. francs.	1924. Thous. francs.	Inc. or dec. Thous. francs.
Dynamo-electric machines.—			
Weighing 1 000 kg. and over ...	31,200	20,100	– 11,100
From 50 to 1,000 kg.	8,400	10,400	+ 2,000
Less than 50 kg....	10,400	17,800	+ 7,400
Electrical and electro-technical apparatus.—			
Wound with insulated wire ...	30,200	39,400	+ 9,200
Not wound with insulated wire	13,800	15,300	+ 1,500
Insulated wire and cable ...	9,000	3,600	– 5,400
Commutators and parts ...	15,200	16,800	+ 1,600
Arc lamps and parts	89	31	– 58
Accumulators and parts ...	2,300	3,700	+ 1,400
Dry cells	80	121	+ 41
Dynamo and motor frames ...	218,000	318,000	+ 100,000
Incandescent lamps.—			
Carbon filament	230	410	+ 180
Metal filament	30,000	44,000	+ 14,000
Without caps	800	940	+ 140

EXPORTS.

Dynamo-electric machines ...	32,800	60,000	+ 27,200
Electrical and electro-technical apparatus	116,000	202,000	+ 86,000
Insulated wire and cable	36,700	52,500	+ 15,800
Commutators and parts	14,000	24,500	+ 10,500
Incandescent lamps	23,400	30 000	+ 6,600
Arc lamps and parts	180	390	+ 210
Accumulators and parts	2,600	6,500	+ 3,900
Dry cells	2,300	2,600	+ 300
Dynamo and motor frames ...	74,000	167,000	+ 93,000

Welding Copper to Steel by Electricity.

By C. H. S. TUPHOLME.

DURING the past few years considerable progress has been made in the welding of copper to steel by electricity, especially in the design of moulds and bonds for, for instance, welding copper cables to steel rails and other similar applications. When the process of copper-steel welding was first tried, it soon became evident that a mould would be required to hold the weld metal, because copper melted by an electric arc is very fluid, and without some such mould it would be impossible to retain the copper in contact with the steel. In effecting the weld, the steel must be hot enough to ensure that rust and scale will be avoided, and that the two metals will bond properly.

Many of the earlier difficulties of copper-steel welding were due to the welding alloy, and considerable experiment was necessary before an alloy could be obtained which would remove the gases from the molten copper and reduce the oxide scale without damaging the steel. Modern alloys for this purpose contain a powerful deoxidiser which not only reduces the oxide scale at a comparatively low temperature, but also produces a weld of good electrical conductivity.

These welding rods are of copper-silicon alloy, and in welding, the alloy next the steel is melted by the arc being played directly upon the copper. Microscopic examination of the welds reveals a bond which is dense and finely grained, and under test the copper and steel shear slowly, very differently from the abrupt break of the earlier copper-steel welds. The weld obtained now is of uniform width, and there is no indication of the hair cracks which were such a feature of the earlier welds. Porosity, too, is absent.

Two methods are in use to-day for effecting copper to steel welds—the copper-electrode and the carbon arc processes. In the latter method the open-circuit voltage is reduced by a dynamotor to about 60 volts, giving a local welding circuit with the rail positive and the carbon electrode negative. In the former process the alloy is melted by the carbon arc, the arc being drawn between the electrode and the mould. Where the carbon arc process is used, the filler rod and the electrode are separate.

The carbon arc process is in more general use for welding copper cable to rails; in this method the rail is first scraped perfectly clean and the mould fitted tightly against the rail web. When the current is switched on, the arc is drawn from the carbon mould and a layer of copper is laid on the rail first and then extended to the cable until the mould is filled with a mass of deposited copper connecting the cable and the rail.

In some cases pure copper rods are used instead of copper-silicon alloy, but the latter has been found to give better results because it makes a weld of no porosity, with the consequence that the electrical resistance of the joint is lower. The shearing strength of the weld is also greater than that obtained by pure copper, the average shearing strength of silicon copper being nearly 30,000 lb. per sq. in.

It has been demonstrated conclusively that the welding of copper to steel does not in any way damage the rail, because the arc is directed upon the copper and not upon the steel, the rail deriving its welding heat from the molten copper and not directly from the arc.

An All-Australian Exhibition.—It is proposed to hold a mammoth "All-Australian" exhibition at Sydney in 1930. This year has been chosen as it is expected that the Harbour Bridge will then be completed, and about the same time a large section of Sydney's new underground railway will be finished and brought into operation.

Legal.

Southport Corporation v. The Birkdale District Electric Supply Co.

THIS hearing of this appeal, the commencement of which was reported in our last issue (p. 720), was continued on April 27th. Mr. Greene, K.C., for the appellants (the Southport Corporation), resumed his address. He submitted that the company's right to make charges for electricity was given for two purposes (1) to maintain the concern, (2) to earn a profit. At the lowest the company before it could escape from the agreement of 1901 had to show that the contract was such as not merely to take away its chance of making a profit, but also interfered with its power of carrying on the concern. There was no evidence that the agreement of 1901 did anything of the kind. The standard adopted would enable the company not only to carry out its statutory duties but to carry them out at a profit. The substance of the transaction was that the profit was limited.

Mr. CLAUSON, for the company, contended that by the agreement of 1901 the company fettered itself in the exercise of the powers, duties and discretions imposed upon it by Parliament, and for that reason the judgment of Mr. Justice Astbury was right.

LORD JUSTICE WARRINGTON: What was there to prevent the company contracting with the local authority?

Mr. CLAUSON: From that point of view the company can within the powers of the memorandum of Association enter into a contract, but I am not prepared to agree that the local authority has any right to enter into a contract with the company as to what it shall charge. It is against the will of the legislature that it should enter into this contract.

On the following day, at the conclusion of the arguments, the Master of the Rolls, in giving judgment, said the case raised an important and interesting point. Mr. Justice Astbury had held that the contract in question was *ultra vires* and that it was so incompatible with the duties and responsibilities of the company, that the company could not legitimately enter into it. The part of the supplemental agreement objected to was that which provided that what could be done in Southport could be done also in Birkdale. That part of the agreement might be of great importance to the dwellers in Birkdale. It might also be of advantage to the company; by it the company might be able to attract a larger number of customers if the consumers could be confident that at no time would the price of electrical energy rise above the price which obtained in Southport. The agreement was not really one which imposed a fetter on the company. It was an arrangement characterised by business prudence and one which the company might legitimately make. It was neither a fetter on any of the company's powers nor a fetter on any right the company might hereafter want to exercise against any owner of property. It was a practical system of charging which might well be brought within the general powers which enabled the company to make special charges so long as such special charges did not give undue preference to a particular consumer. It was not incompatible with the undertaking which the company was charged with the duty of carrying on. He (the Master of the Rolls) thought the appeal should be allowed and the Corporation granted the injunction claimed.

Lord Justices Warrington and Sargant concurred and the appeal was accordingly allowed with costs.

A Rating Assessment Dispute.

ON April 29th, the Court of Appeal, consisting of Lords Justices Bankes and Atkin and Mr. Justice Lawrence, delivered judgment in a test case relating to assessment for rates which may have a bearing upon the rating of electricity and tramway undertakings. The Assessment Committee of the Kingston Union and the Overseers of the parishes of Teddington, Hampton Wick, and Hampton, assessed the rateable value of the Metropolitan Water Board's property in the parishes named by taking a reasonably remunerative rate of interest upon the capital value. The Water Board contended that the assessment should have been based on the revenue and appealed to the Middlesex Quarter Sessions, which, however, confirmed the method adopted. This decision was reversed by a King's Bench Divisional Court consisting of the Lord Chief Justice and Justices Avory and Acton, and the present appeal was made by the Assessment Committee and the Overseers against the judgment of that Court.

Lord Justice Bankes and Mr. Justice Lawrence held that the method of assessment contended for by the Water Board was the correct one, but Lord Justice Atkin dissented. The appeal of the rating authorities was accordingly dismissed, with costs.

It is understood that the matter will be carried to the House of Lords.

Sterling Telephone & Electric Co., Ltd., v. Hassett.

IN the High Court of Justice, Dublin, before Mr. Justice Johnston, last week, Mr. M. Binchy, B.L., made an application on behalf of the defendant, Mr. Thomas Hassett, electrical engineer, of Limerick, to have the hearing of an action brought against him by the plaintiff firm transferred to the Circuit Court at Limerick. The plaintiffs sought to recover from Mr. Hassett the sum of £141, the price of goods sold and delivered. In an affidavit on behalf of the defendant it was stated that the goods in question consisted of radio receiving sets, &c., but they were found to be unsaleable, as messages could not be received on them from certain stations, the reaction units not being correct. It was added that the defendant was willing to pay the money which represented the price of the goods which were saleable.

In an affidavit on behalf of the plaintiff firm, Mr. W. P. GRUNDY, one of the company's travellers, denied the statement that the firm's goods were unsaleable, and said that he had given a successful demonstration at Limerick.

The Judge decided to transfer the action to the Limerick Circuit Court, the costs to be costs in the cause.

British Thomson-Houston Co., Ltd., v. Victoria Electric (Manchester) Co., Ltd., and Hodgkinson.

IN the Chancery Division, on May 1st, Mr. Justice Russell heard a motion on behalf of the plaintiffs for a committal and sequestration order against the Victoria Electric (Manchester) Co., Ltd., and Robert Hodgkinson, the managing director of the company, for breach of an Order of the Court. Mr. TREVOR WATSON, for the plaintiff company, said that no evidence in the matter had been put in by the defendants.

Mr. CHUBB, for the defendants, said he had pointed out to Mr. Trevor Watson the instances under which the breach was committed. The defendants had made very little out of it, and the offence was committed in the hope of being able to save the company. They had offered to pay a certain sum for damages. The company had no assets, and it had sold its remaining infringing lamps, and sequestration would do no good. The managing director expressed his regret, and promised not to offend again.

Mr. TREVOR WATSON said his clients would be satisfied if they were compensated for the damage which they had suffered and the defendants paid all costs rendered necessary by the bringing of these proceedings.

His LORDSHIP said the motion would stand over to let the defendants put their explanation of their conduct in an affidavit. He wanted to know how it was that they came to flout the Order of the Court. The case would stand over until May 8th.

Reviews.

Military Engineering (Technical Training), Vol. II. Electrical Engineering. Pp. 346; plates 106. London: H.M. Stationery Office. Price 3s. 6d. net.

This is a handbook covering the whole range of the generation, transmission and utilisation of electrical energy in accordance with the requirements of military practice. This qualification will affect but slightly the utility of the book as a work of reference and instruction for the general reader, who will find in it a lucid and generally authoritative treatment of up-to-date practice. A knowledge of elementary d.c. and a.c. theory is assumed.

The opening chapters deal with small power stations, switchgear and instruments, the last subject being somewhat superficially treated. The chapter on h.p. transmission and control gear contains useful notes on line drop calculations, installing and paralleling 3-phase transformers, and over-pressure devices. The chapter on distribution is somewhat academic, giving directions for calculating the distribution of currents in networks. The matter of power factor correction is fully treated, and detailed costs of static condensers are worked out, but no account is taken of the possibility of increasing the voltage on the condensers to the maximum of 110 by autotransformers, when the supply voltage is considerably lower. The chapter on cables gives detailed directions for laying and jointing, together with brief notes on fault localisation. We note that the solid system is stated to give complete protection from all soil electrolysis and corrosive action, and consequent freedom from breakdown. The test for the location of a short circuit, given on p. 154, will, we think, be unreliable if the fault resistance be comparable with that of the millivoltmeter. Further chapters treat of the subjects of overhead construction, illumination, and interior wiring, and here again we come across somewhat academic calculations of the drop in the conductors of wiring installations. The table on p. 228, comparing the relative advantages of the different systems of wiring, appears to be strongly biased in favour of C.T.S. It is noted, for instance, that whereas the mechanical protection afforded by metal sheathed wiring is stated to be "fair," that given by C.T.S. is "good." Useful notes are here given on the subject of earthing. The chapter on the practical application of electric power is admirable, giving good outlines of the theory of the various classes of a.c. and d.c. motors, as well as ample notes as to their fields of utility, installation and maintenance. The effect of a change of frequency on the performance of an induction motor is somewhat lightly touched upon. We find it stated that a 50-cycle motor will run at half speed on a 25-cycle circuit, but with a much larger magnetising current and consequently lower power factor. The probability is, however, that

any but a special machine the increase in exciting current would be so excessive as to render the motor useless on the lower frequency. The treatment of a.c. commutator motors is brief, but as illuminating as the reviewer has yet met with in so small a compass. This most useful chapter also gives relevant extracts from B.E.S.A. specifications and I.E.E. wiring rules. The remaining chapters deal with fittings, lamps, and secondary batteries.

The principal illustrations are not included in the text, but are collected together at the end of the book. These are generally good, but we note a lack of final revision in some of the curves and diagrams of connections. Plate 8 gives a diagram of the connections of a d.c. shunt generator panel fitted with two overload and reverse circuit breakers but with no knife switch. In Plate 12 we find that the leads from the busbars to the field coils and rheostats of a 3-wire battery booster are omitted altogether. In Plate 13, which shows the connections of a 3-phase alternator, the earthing isolating switches are inverted, and earth the connections to the oil switch instead of those to the machine, the watt-hour meter is wrongly connected, and there is a plug and socket connection in the lead earthing the secondary wiring of the series and potential transformers. In Plate 101 the curve giving the average power factors of 3-phase induction motors does not represent best practice, and the curve of average efficiency does not correspond with the information given on the previous page.

The book is furnished with a good index and there are lists of plates, illustrations in the text, tables and symbols. We can cordially recommend the work to all supply engineers and students on the score of the useful and authoritative nature of its contents as well as of its very low price.

The J. & P. Transformer Book. By S. AUSTEN STIGANT, M.I.E.E., M.Am.I.E.E.,, and H. MORGAN LACEY, B.Sc., A.K.C., A.M.I.E.E. Pp. xi+400; figs. 275. London: Messrs. Johnson & Phillips, Ltd. Price 5s.

This book is based on a series of "Transformer Abstracts" recently issued by this firm. Much additional matter has been incorporated with the object of making the present volume a thoroughly comprehensive treatise on the theory and practice of the static transformer. The opening pages present clearly and concisely the fundamental theories and equations of the transformer. The addition of design-office formulæ and data renders these pages doubly useful.

Chapters 2 and 3 are devoted to the preparation of inquiries and specifications. The reviewer's experience shows that there is great room for improvement in the former. A careful study of the model inquiries and specifications given will be amply repaid and enable manufacturers to deal expeditiously with tenders. Chapter 4 deals with the materials and processes used in the construction of transformers. More might have been made of the use of the "normal and reverse" method of winding (here termed "section" winding). Its use is not confined to strip coils, but may usefully be employed with crossover coils, thus avoiding the heavily insulated but nevertheless potentially dangerous inside connections. Chapters 5, 6, and 7 deal with the various transformer connections. This subject cannot be dealt with adequately without the use of diagrams and those given throughout this book are clear and accurate and set a standard which all technical authors should aim at. All possible schemes of connections are fully treated.

The "Scott" connection for three-phase to two-phase transformation is treated thoroughly. In view of the numerous change-overs from single and two-phase to three-phase generation that are now taking place, the analysis of unbalanced loading on these units will be useful. It is to be regretted that no mention of a recently-patented scheme for two-phase to three-phase transformation (British patent 216,867, of May 23rd, 1924), has been made as this scheme would appear to have several advantages over the classical connection.

Chapter 9 deals with the installation and maintenance of oil-cooled transformers and should be read in conjunction with Chapters 10-15. A careful study of the points enumerated should enable engineers to obtain the maximum satisfaction from their plant and lessen the repair bill very considerably. Chapter 13 will give readers a very clear idea of the severity of the electrical and mechanical stresses which a transformer has to withstand in service. Very few engineers realise the magnitude of these, and may be inclined to doubt the statements made, but they are absolutely unexaggerated. It is to be hoped that engineers will realise the necessity of placing reliability before low first cost. Chapters 14 and 15 deal with failures and abnormal running conditions. The discussion of unbalanced loading is important where single-phase supplies are given from a three-phase network. The necessity for proper housing and adequate ventilation of transformer sub-stations should have been made more of, as nearly every system in the country is an offender in this respect. Chapters 16 and 17 deal with the influence of transformer connections upon third harmonic pressures and currents, a subject of which Mr. Stigant is an acknowledged authority, and with static balancers for a.c. and d.c. circuits. Chapter 18 discusses the selection and treatment of insulating oils. The B.E.S.A. provisional standard specification for these (No. 148—1923) is given in full in the appendix.

In conclusion, we would congratulate the authors upon the high standard they have maintained both in the reading matter and in the illustrations.

Correspondence.

Correspondents should forward their communications at the earliest possible moment. *No letter can be published unless we have the writer's name and address in our possession.*

Conditions in South America.

I would give my friend "Hispano" in your correspondence columns the advice of *Punch* to those about to get married, namely, "Don't!"

The Argentine Republic is an agricultural and stock-raising country; it has no factories, mills, or foundries, and offers very few openings for engineers or electricians, and these with poor pay. The local supply is fairly adequate, supplemented as it is by more than enough very smart and clever men from Italy.

The tramways have imposing English synonyms. I applied at one and was told that the cashier spoke English—the only one on the system; comment is needless. They, no doubt, treated me civilly; they gave me a large application form to fill up, in which I had to give full particulars about my father and my mother, my excellent wife (which I had not), number of children, was I vaccinated, and several other questions which I duly answered, and heard no more about it. Many, perhaps most, of these concerns, take their current in bulk from large central stations owned or manned by Germans, which to the itinerant Englishman is all the same. Here English capitalists were very slack and Germans wide awake.

The railways, English owned, are hampered by pension laws which make it difficult to employ or discharge anyone.

As to agriculture, &c., you get about 24s. per week and board; poor accommodation, I am told—"bunks" one above the other, as on a ship. A farmer expects you to work six months for nothing.

A first-class lady typist has a much better occupation than a first-class engineer.

Buenos Ayres is like a pantomime city, even the prison or "presidio," as it is called, is a palace; I tried to get in, but was told it was very hard to get out. A good piece of beef is hard to get in any of the cheaper hotels; only old working cattle meat is available, the refrigerators taking all the good meat and sending it to Europe. We throw out as dish water at home better soup than is supplied here. You have more need of an umbrella here than at home. The climate is temperate; cold on the whole.

The soil is marvellously fertile and grows everything useful that we find in tropical and temperate climes, but good roads are few and road material scarce. If "Hispano" has £700 and settles down to farming his future is assured. I met some Scotsmen on the way out who had sold farms in Canada. Finally, I would advise "Hispano" not to go out to any Spanish country "on spec" as an engineer.

W. H. M.

April 26th, 1925.

Improved Methods of Production.

The author of the article entitled "The Improved Production of Electric Motors," in the issue of the ELECTRICAL REVIEW dated April 17th, is to be complimented on his endeavour to create an improvement in industry by advocating more efficient methods in the manufacture of engineering products.

Probably the standardisation of motors is the easiest of the tasks, but it is the writer's opinion that other apparatus, such as switchgear and control gear, will also be found suitable for standardisation.

Owing to the excellent work done by the B.E.S.A. and similar bodies, many inquiries are now received which simply specify that the apparatus is to conform to a certain B.E.S.A. specification. Most manufacturers have brought their products into line with these specifications, so that they at once know that their standard gear will be suitable for the job.

Unfortunately there are still many bodies which have their own specifications, which necessitate considerable alteration or even a complete new design of any ordinary manufacturer's product.

Why cannot these people and the Government use the existing standard B.E.S.A. specifications? Or, if these are unsuitable, can we not make a final determined effort on the lines suggested by the writer of the article under review to evolve specifications which everybody will work to, and then let the manufacturers definitely refuse to work to any other specifications?

It is my opinion that "M.I.E.E." has touched on one of the root evils of our industry when he refers to the valuable time spent by large staffs in catering for "customers' special fads" by continually getting out fancy designs. Obviously it is impossible to quote competitive prices for such jobs without running the serious risk of losing money when the article is made. Only by careful standardisation of parts universally can the article be produced at the lowest possible cost.

Our country is not suffering so much from short hours and high wages as from conservative and inefficient methods of production.

To those who fear standardisation I would say that it does not retard progress. When a certain article has been carefully designed and tried out under working conditions, then it is time to standardise that article from A to Z so that

it may be produced at minimum cost in minimum time. A stepping-stone is then laid down upon which the designers may stand while they turn their attention to greater advances. While investigations and experiments are being made, the standard articles are sold like hot cakes, thereby keeping the business going.

The effect of the industry and foresight of our foreign competitors on our export trade and even on our internal trade is found to be increasing daily.

As a nation we must get down to business so that the articles which are required by other countries may be produced at a lower cost than those of the Germans and Americans.

We know how to do good work. We have brains as good as, if not better than, those of our competitors, but we are slow in rising to action, and often appear to lack imagination.

To the industry of mechanical and electrical engineering I would say, "Rally round the great commercial flag and save the country from bankruptcy." Let us put aside differences of opinion and professional jealousies; give up the armchair way of doing business, and make a great united effort to *obtain orders, execute them to time*, and then *obtain more orders* for ever and ever.

I appeal to every individual manufacturer in the country to look round his workshops and see how he can produce his articles at the lowest possible profitable price without sacrificing quality. Again, I appeal to every man at the bench or in the office to take a personal interest in the work so that the best results may be obtained by hearty co-operation. Remember that increased trade will ultimately mean higher remuneration, together with better working conditions.

Norse.

April 24th, 1925.

Luminous Electric Radiators.

With reference to your comments on Mr. Steele's letter in the ELECTRICAL REVIEW of April 24th, I should like to mention a discussion I had with a well-known member of the electrical profession shortly after my introduction of the luminous radiator, which bears on the subject under discussion. The engineer I refer to is a very prominent man, and has a very complete knowledge of the subject of electrical efficiency. When examining one of my radiators, he said: "I like them and appreciate the genial warmth thrown out like sunshine upon the person, but it is a pity they are so inefficient." My answer was that I considered them very efficient as heat radiators, and I should not have introduced them or advocated their use if I thought otherwise. Indeed, at that time, when current was so expensive, these radiators were the only form of heaters which could be used with economy, as they were meant to warm the person in the same way as sunshine. Electricity was far too expensive to utilise in warming the air of rooms, a large amount of the heat being lost by change of air in ventilation, contact with cold walls, and in other ways. I asked my friend the efficiency of a carbon lamp; he said it was about 4 per cent. Then, said I: "What becomes of the 96 per cent. of the current used in the lamp?" (and here we come to your present query). His answer was the obvious one, that it was used in heating the filament and bringing it up to incandescence. I suggested that as I was out for heat, if I got 96 per cent. efficiency I was not doing badly. He said he had never looked at it in that light before, and it was obvious that I gained in heat efficiency what was lost in regard to light production. I then added that I claimed 98 per cent. efficiency, because my lamps only produced 2 per cent. of light. I now go farther than this and say that what appears to be loss in light becomes heat when absorbed, and, therefore, as far as we know with our present knowledge, we get 100 per cent. efficiency. This is what is claimed when electrical energy is expended in heating a wire, and it amounts to the same when heating a carbon filament. The question now arises: How does this heat and small percentage of light pass out of the lamp? Glass is practically opaque to dark heat rays, and the filament must therefore be heated to the luminous point (low red) before the heat rays can be transmitted. This is about four or five hundred deg. F., and the heat rays, with the increasing light rays, are transmitted in increasing intensity until they reach the maximum (bright red) when they begin to diminish and cease to be felt a little beyond the green of the spectrum. The light rays, however, reach their maximum between the yellow and the green, and, of course, continue up to the actinic and chemical rays. I enclose an illustration which is taken from Dr. Hulbert's book on "Natural Physical Remedies," which will perhaps explain more fully my point. The curves were meant to show the extent of the heat, light, and actinic rays of the visible spectrum, as used in modern medical practice. The subject of heat and light production by electrical means is one of extreme importance at the present time, owing to their extensive use in the application of radiant heat, Finsen light cure, ultra-violet therapy, by means of metallic wire or mercury lamps, and the Sunlight Cure which is coming into extensive use. We shall probably hear of important developments in this direction before long.

I would add that if my applications of radiant heat, which began with the luminous electric radiator, produced no further results than those already attained in medical practice, I should feel satisfied that my time had not been wasted.

I claim, however, that there is a wide field for the luminous electric radiators, when used under proper conditions. They are true radiators of heat. The ordinary radiators with wire elements give off their heat by conduction, convection, and radiation. The luminous radiator gives us out heat in the same manner as we receive it from the sun, and few would dispute the fact that this is by far the best system of warming.

It has been the custom to make luminous radiators to take one kilowatt, whereas most electric heaters at the present time take from two to four kilowatts, and it would be absurd to compare the heat effect of one luminous electric radiator with one of the larger type of heaters, although I have known this to be done without explaining the difference in the consumption of current.

To heat large volumes of air in the ordinary dwelling house, no doubt the wired element type is the most satisfactory for the convection currents it produces, but to warm the person indoors or out, to produce warmth in a draughty passage, or any other position where hot air may be lost, the luminous electric radiator is the only type that can be efficiently used.

With the lamp radiators you first of all warm yourself by direct radiation, and then you warm the furniture, floor, &c., of the room by radiant heat exactly as you would do with the sun shining through the window.

To show the utility of the luminous electric radiator, I may mention that I have warmed dangerous places, such as powder magazines, by placing the radiators *outside* the glass windows, the heat rays passing in as sunshine.

I am afraid that I have occupied too much of your space, but I hope I have been able to convince those of your readers who want convincing, that the luminous lamp radiators are not uneconomical, and that they have a place in our modern systems of heating.

H. J. Dowsing, M.I.E.E.

London, *May 1st*, 1925.

[Everyone knows that all types of electric heater convert electrical energy into heat with an efficiency of 100 per cent. But they impart the heat in different ways—immersion heaters almost entirely by conduction and convection, kettles mainly by conduction, fires mainly by radiation, and luminous heaters mainly by convection. In this connection we may quote from a masterly treatise on "House Heating," just published by Dr. Margaret Fishenden, the well-known authority on this subject:—"The glow lamp heater, consisting as it does of an incandescent wire in an evacuated space, primarily emits the greater proportion of its energy as radiation. *Only a relatively small part of this radiant energy, however, penetrates the dull glass bulb and finds its way directly into the room as radiation, the remainder, and larger proportion, being absorbed by the bulb.* The latter consequently becomes hot, and not only warms the air in its neighbourhood by convection, but also itself becomes a source—though a lower temperature one—of radiation. A single, freely exposed electric lamp radiator may emit radiation which in all directions aggregates as much as 70 per cent. of the current consumed. Backed by a copper reflector, this probably becomes about 60 per cent. The radiation efficiency of a number of lamps as ordinarily framed up side by side in a case, however, is *far below this figure*. . . . When a high-power appliance is required, for example, for the warming of a large room, the lamp radiator is not generally suitable, as the space taken per energy developed is much higher than is usually the case with open wire heaters." (The italics are ours.) In a previous passage the author says: "Holes are usually provided in the top of the frame for the passage of the heated currents of air which rise from the lamps." These quotations leave no room for doubt that Dr. Fishenden regards this type of heater as a convector rather than a radiator, thus confirming our comments on p. 653.

[The point that we wish to drive home is that for domestic use the radiation efficiency is of the first importance, and that in this respect the luminous type cannot be compared with the modern electric fire.—EDS. ELEC. REV.]

Napier-Kimber, Ltd.

I have carefully read Mr. Kimber's letter contained in your issue of May 1st, and I would confirm that the report given by your representative was a very fair and correct account of what transpired.

I read with a good deal of surprise the second paragraph of Mr. Kimber's letter. I was responsible for the question in point, and a perusal of the statement of affairs which was produced at the meeting fails to convince me, or, I should think, anybody else, that "the assets of the company have always been sufficient to cover the debenture held by the bank several times over." I feel sure the creditors would have been only too happy to have seen this position. Unfortunately, however, this position does not obtain, and hence the meeting of creditors.

With regard to the point raised about shareholders, comment is unnecessary and superfluous.

H. Joseph,
Director.
(HENRY JOSEPH & CO., LTD.)

London,
May 4th, 1925.

Business Notes.

Bankruptcy Proceedings.—C. G. HOFMAN (trading as L. J. CHAMBERS & Co.), radio component manufacturer and electrical engineer, Andrew Works, Wandsworth Road, and Victoria House, South Lambeth Road, S.W.—This debtor failed in July, 1924, with total liabilities of £3,626 (unsecured £3,497), and net assets valued at £3,177. Throughout his trading the debtor suffered from epileptic fits, and the control of the business was left largely to a person who furnished certain financial assistance and the debtor, as alleged, induced him to give a bill of sale last June in favour of another person, on the machinery and effects at Andrew Works. The debtor now repudiates the bill of sale and claims £2,494 in respect of cash and the alleged fraudulent removal of stock and a Studebaker car. He attributes his failure to lack of capital, to a falling off of trade during the past summer, and to his inability through ill-health, to supervise his business. The debtor attended on April 28th before Mr. Registrar Francke at the London Bankruptcy Court and his public examination was ordered to be concluded.

O. R. MOUNSEY, Parliament Mansions, Victoria Street, Westminster, S.W.—The first meeting of creditors herein was held on April 30th at the London Bankruptcy Court before Mr. F. Vyvyan, Official Receiver. No statement of affairs was presented, but the chairman reported that the debtor estimated his liabilities at £9,000, and he had no assets of any description. He had stated that he had been engaged in obtaining capital for companies and industrial undertakings. Towards the end of 1921 he came into contact with two other persons, and with money borrowed from them acquired an option to acquire electrical patents. He took offices in Drury Lane, W.C., where he commenced to trade as the Win-Sum Electrical Co. Although he was the registered proprietor of the business, it was managed by others, as he continued to devote his time to financial matters and to finding money to acquire the patents with the object of transferring them to a limited company. That object however, he was unable to achieve; the option expired, and he closed the offices in Drury Lane. He understood that the patentee had since been running the patents. In the absence of any proposal, the estate was left in the hands of the Official Receiver to be administered in bankruptcy, but the debtor intimated that he hoped to be able to submit a proposal which would be beneficial to the creditors.

T. N. SHEPHERD, 15, Bridge Road, Stockton-on-Tees, and 5, Queen Street, Redcar, plumber and electrical engineer.—The adjourned public examination of this debtor was held recently at the Court House, Stockton-on-Tees. The statement of affairs showed gross liabilities of £13,741, and there was a deficiency of £4,710. Debtor attributed his failure to losses on contracts, depreciation in the value of property, and depreciation of stock in trade. He denied that he had lost money on contracts owing to cutting prices. The case was further adjourned.

F. S. BOWEN (Manchester Electrical Co. and F. Bowen and Co.), 7, Brazennose Street, and 43, Thomas Street, Manchester.—First dividend of 2s. 6d. in the £, payable May 13th at 21, Spring Gardens, Manchester.

E. A. THORN, house decorator and electrical engineer, 34, Cedars Road, Clapham Junction, S.W.—First and final dividend of 20s. in the £, plus 4 per cent. interest payable May 14th at the Official Receiver's office, 29, Russell Square, W.C.1.

P. C. LETHERBARROW (Letherbarrow Bros.), electrical contractor, 1, Church Lane, Banbury.—Trustee, Mr. G. Mallam, 7, Cornmarket Street, Oxford, released April 20th.

W. J. DICKEN (W. Dicken & Son), electrical engineer, 2, Upper High Street, Bargoed, Glam.—Trustee, Mr. E. Owen, 34 Park Place, Cardiff, released April 22nd.

R. BALL & Co., 287, Upper Street, Islington, N.—A bankruptcy petition has been presented against this firm by the General Electric Co., Ltd., and will be heard to-day (Friday).

A. T. RAWLINS (Rawlins & Co.), electrical engineer, 357, Upper Richmond Road, Putney.—First meeting, May 8th, at 39, Russell Square, W.C.; public examination, May 28th, at the Court House, Wandsworth.

P. S. KENNEDY (Martin & Co.), electrical engineer, 102, High Street, Stoke Newington, N.—Last day for proofs for dividend, May 15th. Trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.

R. EMMETT (Emmett & Co.), builders, gas and electrical engineers, 249 Goldhawk Road, Shepherd's Bush, W.—First and final dividend of 1s. 9d. in the £, payable at Carey Street, W.C.

B. E. DIXON, trading as the Creswick Dixon Electric Co., at Sheffield and Chesterfield, electrical engineer.—The adjourned public examination of this debtor was held on April 30th at the County Court Hall, Sheffield. The statement of affairs showed liabilities of £2,650, against assets of £330. The examination was closed.

Company Liquidations.—A. DEAKIN & Co., LTD., Victoria Ironworks, Walmgate, York, electrical engineers, &c.—A meeting of the creditors of the above was held recently at York. A statement of affairs was submitted by the liquidators, Messrs. C. M. Tweedale and T. Stott, disclosing liabilities of £3,870, made up as follows:—Trade creditors, £638; bankers, £54; and loan creditors, £1,178. The assets were estimated to realise £549, from which had to be deducted £62 for preferential claims, leaving net assets of £487, or a deficiency as regarded the creditors of £1,383. The issued capital amounted to £800, so that the total deficiency as regarded contributories was £2,183.

It was reported that the business had been in existence several years, and the limited company was formed in July, 1923, with a nominal capital of £1,000. 203 shares of £1 each were issued for cash, and 597 were allotted as consideration for the goodwill of the business taken over. The deficiency was accounted for by the depreciation of assets and losses on contracts during the last 10 months. The company had put down a plant at Ulverston, from which it supplied electricity until a cable was installed. It was estimated that a loss of £400 or £500 had been sustained in that direction. The creditors decided to confirm the voluntary liquidation of the company with the present liquidators. It was understood that steps would be taken to realise the estate as speedily as possible.

HINSON & Co., LTD., 69-71, Argyle Street, Birkenhead, dealers in electrical goods, &c.—A meeting of the creditors was held recently, at the offices of Messrs. Evans, Lockett and Co., Liverpool. Mr. R. Lees, C.A., Birkenhead, the liquidator of the company, submitted a statement of affairs which disclosed liabilities of £7,336, made up as follows:—Trade creditors, £5,774, and cash creditors £1,562. The assets were estimated at £10,290, from which had to be deducted £270 for preferential claims, leaving net assets of £10,020, or a surplus of assets over liabilities of £2,684. The liquidator reported that the company was a very old established one. The nominal share capital was £20,000, of which £18,000 had been subscribed. The directors had decided on liquidation as the business had been steadily losing money for some years, and they considered that if they continued, the chances of the creditors being paid in full would be jeopardised. The profit and loss account at April, 1924, showed a deficit of over £10,000. The turnover of the company in 1922 was £19,686, on which a net loss of £9,568 was incurred. For the year 1923 the turnover was £6,309, and the net loss £497. In 1924 the turnover increased to £14,413, and there was a gross profit of £2,807, but there was a net loss of £1,176. Efforts were to be made to dispose of the business as a going concern. It was decided to confirm the voluntary liquidation of the company with Mr. Lees as liquidator. An advisory committee was also appointed, consisting of Messrs. N. D. Thomas, T. O'Neill, S. Smith (all trade creditors), Mr. C. Turner, of Sheffield, representing creditors, and Mr. P. S. Booth, of Liverpool.

SUTHERLANDS (ELECTRICAL ENGINEERS), LTD.—Particulars of claims to be sent by June 1st to the liquidators, Mr. A. Greenhalgh, 20, Acresfield, Bolton, and Mr. J. O. Young, Central Chambers, 1, Fold Street, Bolton.

NAPIER-KIMBER, LTD., 6, Percy Street, London, W., and Bradford.—Mr. S. H. Gillett, the liquidator in this voluntary winding up, states that the adjourned petition for compulsory liquidation was heard and dismissed by the Court on April 21st.

A. C. ALEXANDRA & Co., LTD.—Last day for proofs for dividend to preferential creditors, May 16th. Liquidator, Mr. G. D. Pepys, Official Receiver, Carey Street, W.C.

RADIO PRODUCTIONS (LEEDS), LTD.—Winding up voluntarily. Liquidator, Mr. C. H. Baker, Standard Buildings, City Square, Leeds. A meeting of creditors was called for yesterday (Thursday).

Private Arrangements.—J. F. GREENHALGH, trading as the North Wales Electrical Co., Greenfield Road, Colwyn Bay.—The creditors interested herein were called together recently, when a statement of affairs was presented which showed liabilities of £856, of which £756 was due to the trade and £100 to cash creditors. The assets were estimated to realise £406, leaving a deficiency of £450. It was stated that the debtor started trading in March, 1924, with little or no capital, and from time to time money had been lent to him by a relative. Accounts were prepared at the end of February last, and it appeared that during the twelve months the turnover was £3,200, with a gross profit of £290, and a net loss of £59. A creditor said that the percentage of gross profit appeared to be small, and it was stated that the debtor had been obliged to cut prices in some instances in order to compete with other wholesale houses. The drawings during the whole period of the trading had been £193. It was decided to confirm the deed of assignment already executed to Mr. W. E. Williams, accountant, 41, North John Street, Liverpool. The principal creditors are:—

	£		£
Hollingdrake & Son	335	B. & B. Wireless	64
General Electric Co., Ltd. ...	109		

Sequestration.—A. C. MCCALLUM, electrical engineer, sole partner of A. C. McCallum & Co., 108, Woodlands Road, Glasgow. A meeting of creditors was called for April 24th to elect a trustee. Agent, Mr. T. Armstrong, 24, St. Vincent Place, Glasgow.

Dissolution of Partnership.—CONSTABLE & OHLSON, electrical and mechanical engineers, 16, Surrey Lane, Battersea, S.W. —Messrs. H. A. Constable, A. D. Ohlson, and H. Broad have dissolved partnership. Messrs. Ohlson & Broad will attend to debts and continue the business

Receiver Appointed.—INGLEBY & CO., LTD., Beeston, Leeds. —Mr. R. E. Starkie, of Starkie & Naylor, incorporated accountants, 6, South Parade, Leeds, has been appointed receiver on behalf of the debenture holders. He reports that the directors are considering the position with a view to endeavouring to submit a scheme for the re-organisation of the business, and that they hope to submit a scheme to the creditors shortly.

Trade Announcements.—MESSRS. R. P. RATCLIFF & CO., who have removed from 81 to 83, Wicker, Sheffield, wish to receive electrical and wireless price lists.

MR. MITCHELL, buyer of electrical goods for Messrs. Montgomery, Ward & Co., mail order distributors, of Chicago, will be visiting this country shortly. Manufacturers desiring information are asked to communicate with Mr. E. Ferguson, 72-73, Margaret Street, London, W.1, whose firm are agents here for the Chicago business.

MESSRS. RIDOUT & RATCLIFF, LTD., have removed to more convenient premises, with a showroom, at 129, Crawford Street, W.1. Telephone: Mayfair 2886.

THE NATIONAL ELECTRICAL SUPPLIES CO. is removing on May 11th from Henrietta Street to 15 and 16, Fisher Street, Southampton Row, London, W.C.1. New telephone No.: "Chancery 8557."

THE ELECTRICAL ACCESSORIES MANUFACTURING CO. has removed to its new factory, Progress Works, Low Hall Mills, Holbeck Lane, Leeds.

MESSRS. ENGINEERING SUPPLIES, LTD., of Blackfriars Road, S.E., have appointed Mr. J. H. Berry, 72, Moor Street, Birmingham, as their district representative for Birmingham and the Midlands.

Mechanical Costing.—At a meeting of the Institution of Production Engineers, which is to be held at the Engineers' Club, Coventry Street, W.1, on Wednesday, May 20th, at 7.30 p.m., Mr. S. C. Downes, of the Accounting and Tabulating Corporation of Great Britain, Ltd., will read a paper on "Mechanical Costing." Responsible engineers are invited to attend the meeting.

Catalogues and Lists.—SLOAN ELECTRICAL CO., LTD., 8-12, Golden Lane, E.C.1.—Two illustrated and priced leaflets dealing respectively with the "Perlume" diffuser and the "Perlume" all-white domestic ceiling fitting.

THE CAMBRIDGE INSTRUMENT CO., LTD., 45, Grosvenor Place, S.W.1.—Two comprehensive illustrated booklets dealing respectively with the firm's d.c. and a.c. measuring instruments.

FULLER'S UNITED ELECTRIC WORKS, LTD., Woodland Works, Chadwell Heath, Essex.—A pamphlet advertising the company's "Redline" leak-free ebonite. Priced.

THE ENGLISH ELECTRIC CO., LTD., Queen's House, Kingsway, W.C.2.—Publication No. 585 containing an illustrated description of the reversing mill drive at the Penistone works of Messrs. Cammell, Laird & Co.

HACKBRIDGE ELECTRIC CONSTRUCTION CO., LTD., Hersham, Walton-on-Thames.—A leaflet containing a reply to a German comment upon the transformers shown at Wembley last year.

MR. ERIC THOMPSON, The Electric Shop, Kirkgate, Thirsk.—A pamphlet dealing with a two-valve radio receiving set, and blotters advertising electrical service.

THE STEAM FITTINGS CO., LTD., West Drayton, Middlesex.—a leaflet illustrating examples of the company's gas and air meters.

THE RELAY AUTOMATIC TELEPHONE CO., LTD., Relay House, Streatham Hill, S.W.2.—An illustrated brochure describing the "Relay" system in non-technical language.

THE SILUMINITE INSULATOR CO., LTD., The Green, Southall, Middlesex.—An illustrated catalogue of "Siluminite" and other insulating materials made by the company, including mouldings of various kinds.

MESSRS. A. B. CLEWORTH & CO., LTD., 118, Queen Victoria Street, E.C.4.—Illustrated pamphlets dealing with the "A.B.C." air filter and humidifying plant.

MESSRS. GOODBRAND & CO., LTD., Britannia Foundry, Stalybridge.—A booklet containing full details and illustrations of the company's fuel economisers; also a list of users of these.

MESSRS. L. MCMICHAEL, LTD., Hastings House, Norfolk Street, Strand, W.C.2.—A priced and illustrated pamphlet describing h.f. transformers, condensers, &c. Also a monthly sales letter.

THE JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, S.W.1.—A blotter card bearing an illustration of the company's "Model 20B" cooker and a calendar for May.

M. EDOUARD HIRSCH, 46, Rue de Paradis, Paris, X.—An illustrated brochure describing manufactures of *basalte fondu*, including insulators of various kinds.

Guatemalan Trade-mark Regulations.—A copy of the translation of a new Trade Marks, Names, and Advertisements Law and of the regulations thereunder has been received by the Board of Trade from a British representative in Guatemala City. This can be seen at the Patent Office Library.

The Basle Water-Power Exhibition.—The participation is announced of the German Government and of Dutch interests in the International Exhibition of Inland Navigation and Water-Power Development which is to be held at Basle next year. The water-power section is to include exhibits of mechanical and electrical plant, such as turbines, generators, switchboards &c. Applications for space at the exhibition must be sent in not later than December 31st, 1925, to the Organising Secretary, Basle.

Unemployment.—The total number of unemployed registered on April 20th was 1,202,700. This was 2,670 less than on April 13th, but 152,154 more as compared with the figure for the equivalent date of last year.

British Trade-mark Applications.—The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be lodged within one month from April 22nd. In the case of foreign applications, the name and address of the British representatives are also given:—

T. C. C. No. 452,964. Class 8. Electrical condensers.—The Telegraph Condenser Co., Ltd.

Eike (lettering and design). No. 453,675. Class 8. Headphones for use in radio-telephony.—Liesegang & Kosch Gesellschaft, 15-19, Monckebergstrasse, Hamburg. (W. Fairburn-Hart, 13, Bond Street, Leeds.)

Wilcolator. No. 455,495. Class 8. Thermostatic control instruments.—T. H. A. Wilson Co., 97, Chestnut Street, Newark, N.J., U.S.A. (Marks and Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

Norbex Trade Mark (lettering and design). No. 455,726. Class 8. Philosophical and scientific instruments for useful purposes.—Roland F. Graham, trading as R. F. Graham & Co., 101, Gloucester Road, Kingston-on-Thames.

Nonres. No. 456,361. Class 8. Apparatus for use in radio-telegraphy and telephony.—W. Bullen, 38, Holywell Lane, E.C.2.

Chantry Radio, Rotherham (lettering and design). No. 456,814. Class 9. Radio-telephonic apparatus.—S. E. Dawson, 79, Jaine Street, Rotherham, Yorks.

Amplite. No. 455,487. Class 50. Celluloid and viscose sold in sheets, blocks and slabs for industrial purposes.—E. A. Graham, trading as Alfred Graham & Co.

Objections to the following must be made within one month from April 29th:—

English Electric Company, Limited (lettering and design). No. 455,90[illegible]. All goods in Class 6.—English Electric Co., Ltd.

Triumph. No. 454,337. Class 8. Flexible insulated electric cables for the reception of radio messages.—R. K. Stell, 7, Kirklands Avenue, Baildon, Shipley, Yorks.

Satis (lettering and design). No. 456,392. Class 8. Apparatus for use in radio-telegraphy and telephony.—E. W. Smith and J. S. T. Streeter, 22, Church Lane, Charlton, S.E.7.

Connode. No. 456,379; and Seamark. No. 456,380. Class 8. Instruments and apparatus, and parts thereof, for use in connection with radio-telephony and telegraphy.—C. E. Needham & Brother, Ltd., 20-26, Change Alley, Sheffield.

Monophon. No. 456,876. Class 11. Electrical apparatus and instruments for use in therapy.—The General Radiological and Surgical Apparatus Co., Ltd., 204-206, Great Portland Street, W.1.

Stabec (lettering and design). No. 456,894. Class 16. Electrical insulators.—The New Eccles Rubber Works, Monton Road, Eccles.

Ebolite. No. 457,111. Class 40. Electrical insulating materials made wholly or principally of india rubber.—S. G. Leach & Co., Ltd.

Pixtonet. No. 455,176. Class 50. An electrical insulating substance made chiefly from slate, and sold in slabs, blocks, or sections.—Cornelius Pickston, Nursery House, Radcliffe, Lancs.

Ankh Moulded Insulators (lettering and design). No. 453,704. Class 9. Electrical insulators made of a mouldable composition.—The Ankh Insulator Co., 28-30, Eagle Street, W.C.1.

CORRECTION.—Trade Mark No. 456,139, registered by the Electrical Equipment & Carbon Co., Ltd., is "Telwave," not "Telware," as given in our issue of April 3rd.

The G.E.C. Electric Home.—The General Electric Co., Ltd., has arranged an "electric home" at its premises in Kingsway. In a series of rooms representing a bungalow electrical apparatus of all kinds is displayed and demonstrated. A Press view was held on May 1st, and the current week has been specially allotted to the trade.

A Business Barometer.—Issued with *British Industries* for April 30th was the quarterly "business barometer" prepared by the Federation of British Industries. It is claimed that by means of this review of financial and economic conditions it is possible to forecast ahead, with a fair degree of certainty, forthcoming changes in business conditions. Curves are reproduced showing the post-war world production of pig iron and steel by quarterly averages. Another curve shows the state of employment in our principal industries from 1920 to the beginning of 1925. This shows that the engineering and shipbuilding industries have been consistently below the other industries (textiles, building, metal, and coal mining), although since 1922, when a very low level was reached, there has been a steady improvement until it has risen above coal mining. Employment in the latter industry has declined considerably since the early part of last year. A chart of post-war price movements shows a sudden descent in 1920-21, since when the fluctuations have not been very violent. The last chart is of a miscellaneous character, showing the variations in a number of factors which affect business, and in business itself, *e.g.*, the Bank rate, bank advances, imports and exports, steel and iron production, railway tonnage, &c. The publication concludes with a forecast of conditions for the second quarter of 1925. It is stated that the effect of raising the Bank rate to 5 per cent. and continuing the embargo on foreign investments forced up the dollar/sterling exchange. As a result of the over-valuation of the pound sterling British selling prices and labour costs have been raised appreciably. The restoration of our full competitive power requires the forcing down of our prices and costs until they are in adjustment with the value of the exchange as fixed by our monetary authorities.

For Sale.—By direction of the George Cohen & Armstrong Disposal Corporation, Messrs. Fuller, Horsey, Sons and Cassell, Ltd., will sell by auction, on June 8th, and following days, at the Baltic Exchange, E.C., electrical plant and machinery lying at various Government depôts in London and the provinces. Fulham Borough Council Electricity Department has three boilers for disposal. Preston Corporation Electricity Department invites offers for surplus steam and electrical plant installed at the Crown Street power station. Wolverhampton Corporation Electrical Engineer's Department has for disposal one 4,000-kW turbo-alternator, condenser, and auxiliaries, also two 3,000-amp. battery boosters. Messrs. Hillier, Parker, May & Rowden have for sale the lease of a city factory, with possession, close to Moorgate Street Station. Manchester Corporation Electricity Department has for disposal surplus electrical stores, including ammeters, switches, motors, &c. Glasgow Corporation Tramways Department invites offers for surplus sub-station converting plant. (See our advertisement pages to-day.)

Australian Electrical Imports.—The imports of insulated electric cables and wire into Australia during the six months ended December last, amounted to a value of £830 807, as compared with only £462,076 in the corresponding half of 1923. During the same period the imports of other electrical machinery and apparatus, n.e.i., advanced from £1,745,784 to £2,511,529.

Exhibition of Trade Journals.—A large number of trade and technical journals have formed a permanent organisation for the exhibition of these publications. There is a Central Bureau in London, at 2 & 4, Tudor Street, E.C.4, where 100 different class periodicals are on view for the inspection of those interested, but an important feature of the organisation is a Travelling Bureau—a duplicate of the London exhibit—which will journey from place to place. This Bureau opens its first tour at the Birmingham Chamber of Commerce on Monday next, May 11th; it remains there until the 15th inst. On Monday there will be a meeting addressed by representatives of trades, industries and journalism at 2.15 p.m.

Book Notices.—"Practical Humidity Tables," compiled by the technical staff of A. B. Cleworth & Co., Ltd. Pp. 123. London: Taylor & Francis. Price 6s. net.—The tables are most suitable for engineers, textile manufacturers, &c. The first half of the book is devoted to tables based on Centigrade temperatures and the second half to Fahrenheit. The tables are based on Professor Glaisher's Hygrometrical Tables, and are published with his consent. The following data are given for all wet and dry temperatures:—dew-point temperature elastic force and vapour, vapour per cu. ft. of air, degree of humidity, and weight per cu. ft. of air.

"Year Book and Directory of the *South African Mining and Engineering Journal*," 1925. (Pp. xcvi+242.) London: Argus South African Newspapers, Ltd. Price 12s. 6d. post free.—As in previous years, this year book reviews the conditions and developments in the South African mining and metallurgical industries during the past twelve months. Among the special articles is one on the "Brush-Ljungström" turbo-generator. There appears to be an increasing use of electricity in the collieries of the Union, and in one report, that of the Transvaal Silver and Base Metals, Ltd., mention is made of tests of ore bodies by means of electrical prospecting; no details of the system employed are given, however.

"The Balancing of Reciprocating Engines," by G. A. Stephens. Pp. 54; figs. 36. The Technical Association of Engineering and Shipbuilding Draughtsmen, 96, St. George's Square, London. Price 2s. net.—Commencing with a study of simple harmonic motion, the book leads on through considerations of rotating masses, accelerating forces, &c., to the more involved considerations of the balancing of various types of engines under various conditions and speeds. The diagrams are simple and clear and render the advanced explanations readily conceivable.

"The Technology Reports of the Tôhoku Imperial University, Sendai, Japan." Vol. IV. No. 4. Tokio and Sendai: Maruzen Co., Ltd.—This number contains: "Influence of a Varied Discharge on the Motion of Water and its Pressure in the Draught Tube of a Water Turbine," by Otogoro Miyagi; "On the Measurement of the Natural Frequency of an Induction Coil at Audio-Frequency," by Heiichi Nukiyama; and "Synthesis of Natrium Cyanide from Natrium Sulphate," by Hosaburo Hara.

"Tait's Electrical Directory of Australia and New Zealand and Electrical Handbook" (258 pp.). Melbourne: Tait Publishing Co. Pty., Ltd. Price 7s. 6d.—This is an ever-growing directory of increasing importance as electricity supply forges ahead in the Antipodes. Each edition includes a number of new undertakings; the sixth edition not only embodies these, but also a new section containing alphabetical and classified lists of electrical firms and Australian representatives of British electrical concerns.

"The Slide Rule and its Application in Office, Foundry, Factory, and Mill" by A. Williams Price. Pp. vii+56; illustrated. Birmingham: Cornish Bros., Ltd. Price 3s. 6d. net.—This contains a description of the slide rule, with many practical examples of its application.

"On Periodicities in Climatic and Economic Phenomena and their Co-variation." By Axel F. Enström. 56 pp. Stockholm: A.B. Gunnar Tisells Tekniska Förlag. Price kr. 3.00.—This treatise endeavours to show by a study of cyclic variations over a long period of years the relationship between sun-spot frequency, temperature, harvests, and industrial production.

The Annual Report and Accounts of the British Legion, 1924 (97 pp.). London: The British Legion.—This report contains an account of the activities of the various sections of the Legion during the year, and shows that, although the war is now a long way past, the need for the Legion has not greatly diminished.

Technologic Paper No. 271 of the Bureau of Standards. "Measurement of Electrical Resistance and Mechanical Strength of Storage-Battery Separators" (10 cents). Washington: Government Printing Office.

"Science Abstracts" (A & B). Vol. XXVIII. Part 4. April 25th, 1925. London: E. & F. N. Spon, Ltd. Price 3s. each net.

"Electrical Wiring Rules of the Institution of Engineers, Australia." Pp. xiii+50. Sydney, N.S.W.: The Institution. Price 6d.—The rules were prepared at the Interstate Conference, Melbourne, February, 1922, adopted by the Institution, May, 1922, and revised September, 1923.

"The *Journal* of the Royal Technical College, Glasgow." No. 1. December, 1924. Price 5s.—A record of some of the research work carried out in the college by the staff and senior students.

"Electricity for Everybody," by R. Borlase Matthews. Third and Revised Edition. Pp. xi+251; illustrated. London: Electrical Press, Ltd. Price 7s. 6d. net.

"House Heating," by M. Fishenden. Pp. 296; figs. 57. London: H. F. & G. Witherby. Price 25s. net.

"The Marvels of Modern Physics," by J. McCabe. Pp. vii+120. London: Watts & Co. Price 2s. 6d. net.

"Electric Welding," by L. B. Wilson. Pp. xii+106; figs. 79. London: Sir Isaac Pitman & Sons, Ltd. Price 5s. net.

"Engineering Abstracts." January, 1925. No. 22. London: Institution of Civil Engineers.

"Central Station Voltages and Charges throughout the United Kingdom." Pp. 61. London: S. Rentell & Co., Ltd. Price 1s. net.

"Theoretical and Applied Electrochemistry," by M. De Kay Thompson. Pp. xviii+551; 218 figs. London: Macmillan and Co., Ltd. Price 20s. net.

"Transformer Standards of the Electric Power Club, Cleveland, O." Fourth Edition, 1925.—Contains the new standards which have been adopted since the previous edition (1924).

Australian Tariff Decisions.—Among the recent decisions with regard to the Australian customs tariff are the following:—Steel-cored aluminium cable: British preferential tariff, free; intermediate tariff, 5 per cent.; general tariff, 10 per cent. Bare copper wire: 30 per cent., 40 per cent., and 45 per cent., respectively. Enamelled wire: free, 5 per cent., and 15 per cent. Cotton-covered wire, 25 per cent., 30 per cent., and 40 per cent. Resistance wire for electrical apparatus: free, free, and 10 per cent. Alternators, 85-kW and 140-kW, and 120-kW dynamos: free, 5 per cent. and 10 per cent. Crude-oil engines (94 h.p.), and suction-gas engines (270 h.p. and 135 h.p.): free, 5 per cent., and 10 per cent.

Award for Wind Dynamo.—The Highland and Agricultural Society of Scotland has awarded a "new implement" medal to the Glasgow Electrical Engineering Co., Ltd., for its "Apex" wind dynamo.

Western Electric Record Turnover.—The *Financial Times* states that during 1924 the sales of the Western Electric Co. (U.S.A.) totalled $1,000,000 for every working day, the greatest year since the company was organised 55 years ago. Sales for 1924 amounted to approximately $300,000,000, against $255,000,000 in 1923 and $210,900,000 in 1922.

E. D. A. Activities.—The British Electrical Development Association has issued a brochure describing the "Electric House," which was arranged by the Association and the Electric Lamp Manufacturers' Association at the recent Ideal Home Exhibition. Views of the exterior and each room are reproduced.

Conditions in Sweden.—The *Swedish Economic Review* for the first quarter of the current year states that, although in the last three months of 1924 employment in the engineering industry showed a certain improvement, this must to a certain degree be ascribed to the endeavour of works to hasten to complete orders in view of the threatened labour trouble. Prices for engineering products are very depressed on account of the competition both in home and export markets; in the latter not only German, but also Czecho-Slovakian and Danish firms, have been trying to obtain a footing recently. The apparently low prices at which foreign countries are now offering their products—especially electrical machines and material—are not only significant of lower wage costs, but are to a very large extent the result of measures of economy in production upon the part of the manufacturers. On the other hand, it is claimed, Swedish products maintain their high pre-war quality, and their higher prices are justified by their longer and more satisfactory service.

New Swiss Company.—La Société d'Electricité de Fionnay is the name of a new company which has lately been formed at Bagnes (Valais Canton) to establish a central electric power station at Fionnay.

Australian Electricity Meters.—At a meeting of the Tariff Board in Sydney (N.S.W.), in March, an application was made for the imposition of a minimum fixed duty on imported a.c. house service meters. A director of the Electricity Meter Manufacturing Co said that his firm was able to produce the whole of the requirements of the Commonwealth in this direction In the past few years the company had been able to reduce its prices considerably, but imported meters were always priced a little lower. He asked for the placing of a flat rate duty of 10s. on British meters and 15s. on foreign meters, or, alternatively, the existing rates of 35 and 45 per cent. *ad valorem*, respectively, whichever rate was the higher.

Chinese Notes.—The Tsing Hsin Storage Battery Factory was recently started in Shanghai.

The fares on the tramways in Shanghai, operated by the Chinese Electric Power Co., Ltd., have recently been increased.

A Japanese firm has received a contract from the Hupeh military authorities for the construction of a radio-telegraph station at Ichang.

Peking and Tientsin each have a radio broadcasting station rated at .5 kW. Both of them are heard at Mukden, Shanghai and Japan. They were built by the China Electric Co. for the Ministry of Communications about a year ago, when the Ministry had a plan for radio-broadcasting. As this plan has not been carried into effect the stations have only been used occasionally to transmit special messages when the wires have been unable to handle them. It is planned to transfer one of the stations to Shanghai as one will be enough to serve both Peking and Tientsin.

Two-way radio-telephone communication was established between Shanghai and Osaka, Japan, in March. The Shanghai station is operated by the Kellogg Switchboard Company and the *China Press*.

An Australian View.—The *Industrial Australian and Mining Standard* recently published the report of Mr. Allbut, the municipal electrical engineer of Newcastle (N.S.W.), upon the results of his tour in England and North America. In the course of his report Mr. Allbut comments upon the rapid growth of the electric cooking business in parts of London, especially mentioning Hackney, and says that from what he learned in England he would anticipate "that within the next year or two electric stoves will be manufactured and installed at the rate of 30,000 to 40,000 a year, and in ever-increasing numbers."

South Africa and Imperial Preference.—In the course of the discussion on the new Budget proposals, which was reported in *The Times*, Mr. Jagger asked whether, in the event of the Union's negotiating with a foreign nation an agreement giving the nation the minimum rates on certain commodities, Great Britain would also be entitled to such minimum rates, or whether the foreign nation would pay lower duties on those commodities than Great Britain. General Hertzog replied that Great Britain could bargain for those rates as well as any other nation. Mr. Jagger described it as "base ingratitude" to give foreign nations preference in certain articles over Great Britain

Electric Steel Production in Chile.—*Commerce Reports* states that the Cia Electro-Siderurgica e Industrial de Valdivia, which was formed during 1924, has a large scheme in hand for the electrical production of steel. A hydro-electric plant is under construction, and it is proposed to install three 4,800-kVA Grönwall furnaces, each fitted with six Soderberg electrodes; one Talbot-type 50/100-ton open-hearth electric furnace; two 3,000-kVA electric finishing furnaces of 10 tons capacity each; a 2,000-kVA foundry furnace, and other electrical equipment. The plant, as designed, will have a normal annual output of 45,000 tons of iron and steel.

Austrian Electrical Exports.—*Commerce Reports* says that Austrian exports of electrical goods, according to the latest available statistics, showed little change in volume during the first half of last year, but there was an increase of about 50 per cent. in their value as compared with the first six months of 1923. Exports to Italy showed a slight increase which was attributable to an order for the equipment of an 8,000 h.p. hydro-electric undertaking. Even though tariff rates in Czecho-Slovakia and Hungary are high, Austrian exports to these countries during 1924 were slightly larger than during the previous year. Greater sales to Hungarian dealers, on a contingent basis, were stopped by the excessively high tariff which came into force on January 1st, 1925. Austrian exports of electrical goods to Switzerland were also a little above those of the preceding year. The value of electrical equipment exported to Poland, Rumania, and Jugo-Slavia during 1924 showed a decline. In the case of the first two countries this was due to financial stringency. A revival of trade with Jugo-Slavia is anticipated and exports to Czecho-Slovakia may increase.

English Trade with Russia.—It is reported from Moscow that a representative of the Becos Trading Company has arrived there on behalf of the 200 British firms who are embodied in this association. In the course of an interview with a representative of the official organ of the Council of Labour and Defence the representative is reported to have stated that despite the postponement of the ratification of the agreement between Great Britain and Russia, the members of his association continued to take a favourable view of the possibilities of the development of trading relations. Although there still existed a number of difficulties in this direction, "Becos" had not discontinued its labours, carrying them on through the London representatives of the Soviet organisations. The visit of the representative to Moscow has in view the development of these trading relations and the conclusion of agreements directly with the State organisations, to which the association can now grant credit in a considerably greater measure than has hitherto been proposed. The principals of the association consider that a much greater development of trading is possible, and that under existing conditions it would be appropriate to sell their goods to the Soviet organisations on a consignment basis. At the present moment, according to the report, "Becos" is prepared to deliver various goods on consignment, as, for instance, works "instruments," technical accessories, metals and metal manufactures, agricultural implements and accessories, instruments and materials for the mining industry and equipment for the textile and sugar industries, all for an amount of some millions of roubles. Besides these matters the Society offers to construct port and elevator equipments; in fact one of the members of the association is already occupied on port equipment at one of the Southern harbours.

Football Success. — The Alton Battery Company's works football team have won the Alton and District Challenge Cup, which was competed for by 15 teams. We understand that they are known in Hampshire as the "Sparks."

New French Company.—La Compagnie Bourguignonne de Transports d'Energie is the name of a new company which has lately been formed in Paris (16, Boulevard Malesherbes), with a capital of 30 million francs.

New Zealand and British Electrical Goods.—A statement made by Sir Francis Bell, the New Zealand Attorney-General, with reference to an alleged attempt on the part of British manufacturers to fix increased prices in New Zealand for certain electrical goods has, states the Australian *Hardware and Machinery*, been referred to electrical importers. They acknowledge increases for cables and lamps, but state there is a full explanation of it. For years British manufacturers had been supplying Australia and New Zealand with cables at the cost of production and often for less. They had continued this practice in the hope that the position would improve, but cut-throat competition had hitherto prevented this. Now, if New Zealand was to receive supplies of electrical equipment from England she would have to do so at a price which would make the trade worth while to the manufacturers.

Foreign Radio Apparatus. — It was stated at a recent meeting of the Liverpool Radio Traders' Association, that nearly all the trouble that arose from price cutting was due to the sale of Continental radio parts. Several speakers gave it as their opinion that if the sale of these parts were restricted and the public demand diverted to British supplies, for which there was a fixed retail price, many of the difficulties besetting retail tradesmen would be overcome. As against this point of view, however, it was urged that there was a strong public demand for the cheaper Continental products, and unless that demand could be met, there was a possibility that wireless users by reason of their limited spending power, would not turn to alternative British manufactures.

Peel-Conner Developments.—The *Birmingham Post* states that owing to the shortage of suitable labour at Coventry, the Peel-Conner Telephone Company has decided to reopen its old factory at Manchester. The company removed from Manchester to Copsewood, Stoke, Coventry, a few years ago, and its new works now cover a wide area and employ 3,000 hands. Recently £120,000 has been expended on extensions, and if Coventry could provide the necessary labour further additions would be made. There is ample room for expansion at Copsewood, and the company has an abundance of work, but the scarcity of girl and boy labour in Coventry gives the firm no option but to re-open its Manchester works. The firm is also experiencing a difficulty in securing sufficient skilled men, particularly instrument makers and tool makers. It is anticipated that the Manchester factory will soon employ 500 hands and ultimately a thousand. In order to tap another source of labour the company has recently opened a branch factory at Longford, near Coventry, and unsuccessful efforts have been made to find a suitable place in Birmingham.

New Zealand Radio Regulations.—The *Board of Trade Journal* states that the Trade Commissioner in New Zealand has forwarded to the Department of Overseas Trade a copy of the regulations for radio receiving, amateur transmitting and receiving, and experimental stations, published in the *New Zealand Gazette* on March 5th. A copy of these regulations, which came into force on April 1st, can be consulted by interested British firms at the Department, 35, Old Queen Street, S.W.1, or it will be forwarded upon request to firms after May 1st.

The Depression in the Engineering Industry.—Speaking at the annual meeting of Messrs. Fairbairn Lawson Combe Barbour, Ltd., on April 28th, the chairman (Mr. J. Campbell Inglis) said that in 1924 the company sustained the first substantial loss since its institution 28 years ago. The engineering industry of this country was passing through a period of grave depression, although he was hopeful that the worst had been passed. The employés had asked for higher wages but unless their output was greatly increased it was impossible for the industry to accede to the demand. German competition in the textile machinery market was very severe, and competition at home had resulted in the acceptance of contracts at unsatisfactory prices.

The Rating of Machinery.—We have received from the Machinery Users' Association memoranda relating to the Bill which it is promoting in connection with the rating of machinery. The principal object of the Bill is to reinstate what is claimed to be the original purpose of the Statute of 1836, viz., that only such plant and structures shall be taken into account which are so attached to the freehold as to become part of it and therefore rateable *per se*.

Copper and Lead Prices.—Messrs. F. Smith & Co. report May 5th:—Copper (electrolytic) bars, £64, 25s. decrease; do. do. sheets, no change; do. do. wire rods, £74, 30s. decrease; do. do. h.c. wire, 9 5/16d., ¼d. decrease.

Messrs. James & Shakespeare report May 5th:—Copper bars, best (selected) sheet and rod, no change; English pig lead, £33 15s., 20s. decrease.

Lighting and Power Notes.

Ardnamurchan.—UNEMPLOYED SCHEME.—Mr. Clark, of Ardnamurchan is starting works for unemployed in the district. Shell Bridge mansion is to be supplied with electricity, energy being obtained from a loch in the neighbourhood, and a power station erected. The scheme will cost several thousand pounds.

Ayrshire Electricity Board.—The Board states that, in view of electric cooking and heating having proved itself to be reliable and economical, it has agreed to hire out both electric cookers and heaters. The assessment value system will be adopted, *i.e.*, a charge of one-eighth of house assessment per annum plus 1d. per kWh for all energy consumed.

Birmingham.—PROGRESS OF SUPPLY.—A report on the progress of the Electricity Supply Department was submitted at a recent meeting of the Electricity Committee. During the quarter ended March 31st last, the gross revenue was £352,300, an increase of £38,000, as compared with the first quarter of last year. During March 521 new consumers were connected to the mains.

Blackburn.—ELECTRICITY ORDER.—At a recent meeting of the Rural District Council reference was made to the application of the Lancashire Electric Power Co. for an Order to supply Billington with electricity. It was stated that the company had decided upon a maximum charge of 10d. per kWh, to which the Clitheroe Town Council had raised an objection on the ground that it was too high. It was decided not to sanction the scheme unless the maximum price was reduced to 8d. per kWh.

Blackpool.—ELECTRICITY IN BULK.—The present capacity of Blackpool Corporation electricity works is 10,750 kW, and during the last four years the output has doubled. Negotiations are now proceeding to obtain bulk supplies from Preston's new station. These provide for a minimum supply of 7,000 kW, increasing to 10,000 kW.

Bradford.—ELECTRICITY EXTENSIONS.—The Corporation Electricity Committee has proposed a scheme of mains extensions at an estimated cost of £32,000, which it is hoped will provide work for the local unemployed over a period of about 12 months. The scheme is for extensions in the out-districts of Sandy Lane, Allerton, and Thornton, and it is hoped to secure the usual Government grant.

Bridlington.—ELECTRICITY IN SMALL HOUSES.—The Town Council has decided, by way of experiment, to install electricity for heating and cooking in twelve of the Corporation's houses which are in course of erection.

Brighton.—LOAN SANCTIONED.—The Electricity Committee has received sanction to the borrowing of £5,800 for the laying of mains in connection with the Preston Park and Graves Road sub-stations.

Chorley.—ELECTRICITY IN SMALL HOUSES.—The Housing Committee is making inquiries as to the cost of installing electricity instead of gas in houses in course of erection on the Highfield Estate.

NEW SUB-STATION.—The Lancashire Electric Power Co. is to erect a sub-station in Westwell Road, and to lay a trunk main in several streets.

Continental.—ITALY.—The Società Ligure Toscane di Elettricità, in its report for 1924, states that the output of its plant last year amounted to 147,974,700 kWh, as compared with 129,982,600 kWh in 1923. The operations during the year were considerably hampered by the shortage of water, and it has been decided to extend the plant at the reserve steam power station.

According to the report for last year, the Società Elettrica del Valdarno is now supplying electricity to 118,727 consumers, equal to 62,501 kW, as compared with 104,949 and 55,454 kW respectively in 1923. In order to meet the increasing demand the company is extending its plant and is also establishing 70,000 and 120,000-V transmission lines to connect its system with those of other large supply undertakings in Italy.

POLAND.—The Société d'Entreprises Electriques en Pologne, a Belgian undertaking, has secured the concession for the establishment of an electricity station in the town of Czenstochowa.

SWITZERLAND.—The St. Gall-Appenzell Kraftwerke Gesellschaft, in its recently issued report for last year, states that the number of consumers has increased from 10,461 in 1914 to 32,194 at the present time and the electricity demanded from 28.9 to 59.5 million kWh. The output of the company's own plants has advanced from 21.95 to 25.3 million kWh and the amount drawn from outside supply undertakings from 6.95 to 25.3 million kWh. At the present time the company owns 88½ miles of 45,000-V transmission lines, 323 miles at 10,000 V, 43 miles at 2,000 V, and 737 miles of l.p. mains.

Cranleigh.—SUPPLY BY A GAS COMPANY.—A special resolution has been passed by the shareholders of the Cranleigh Gas and Coke Co., Ltd., authorising the company to undertake the business of electricity supply in the district. Application has been made to the Guildford County Court for an order to extend the objects of the company for this purpose and the petition is to be heard on June 11th.

Crediton.—ELECTRICITY SUPPLY.—The Urban District Council has conferred with its consulting electrical engineer, Mr. L. Melhuish, with regard to a letter from the Electricity Commissioners relating to the Council's application for an Order to supply electricity to the town. The Commissioners suggested, in view of the fact that the Exeter City Council was prepared to offer fresh terms for a bulk supply from Exeter, that the Council should send a deputation to London to discuss the question. The deputation was appointed, and the engineer was asked to accompany it.

Crewkerne (Somerset).—ELECTRICITY SUPPLY.—Two applications for electricity Orders came before the Urban District Council at a recent meeting. The larger scheme related to an area extending from Bridport, in Dorset, to Martock, in Somerset, and with regard to this the Council instructed its clerk to lodge notice of objection. The other was a local scheme proposed to be carried out by Mr. E. R. F. Coleberd, and it was resolved that he should be invited to meet the Council and discuss the proposal with a view to receiving the authority's support.

Darlington.—NEW PLANT.—The Electricity and Tramways Committee has decided to apply for permission to proceed with an extension of the generating plant at the electricity works and to install a 6,000-kW set at a cost of £55,000.

Erith.—LOAN.—The Urban District Council has applied for sanction to a loan of £12,096 in connection with the scheme for obtaining a bulk supply of electricity from Woolwich.

Fishguard.—PROPOSED ELECTRICITY SCHEME.—At a meeting of the Urban District Council, on April 21st, a letter was read from Mr. H. O. H. Wenmann submitting proposals for the formation of a local company to be called the Fishguard Electric Supply Co., with a capital of £5,000, to supply electricity in the district. The probable cost to consumers was stated to be 10d. per kWh for lighting and 3d. per kWh for power. The Council decided to provisionally sanction the scheme, subject to a satisfactory scheme and terms being submitted to the Council which would safeguard the interests of the public.

Glasgow.—WIRING OF SMALL HOUSES.—The manager of the electricity undertaking has reported to the Sub-Committee on Propaganda that 732 houses have been wired since August, 1924, and that the number of applications for the hire of appliances during the month of March was 196.

Hastings.—ELECTRICITY CHARGES.—The Electricity Committee has decided to charge a maximum price of 1s. per kWh in the added area of supply.

Irish Free State.—LIFFEY ELECTRICITY SCHEME.—The Free State Joint Parliamentary Committee on the Dublin and District Electricity Supply Bill, promoted by the Dublin Corporation for the harnessing of the River Liffey, has passed the preamble, but it was held that the preambles were not proved in the cases of the East Leinster Electricity Supply Bill and the Dublin Electricity Supply Bill, promoted by outside syndicates. The Joint Committee will meet in June to consider the clauses of the Corporation Bill. At this further inquiry counsel will appear on behalf of various Boards and Councils in Dublin, Wicklow, and Kildare. The Corporation scheme is £1,130,000.

Luton.—LOANS SANCTIONED.—The Town Council has received sanction to the following loans:—£3,685 for mains; £375 for buildings; £6,706 for rotary converter; £940 for rectifiers.

NEW CABLE.—The Electricity Committee has decided that a duplicate cable for the Dunstable supply and the additional feeder cable for the borough supply be laid at the same time as the Dunstable main cable.

London.—LOANS FOR ELECTRICITY PURPOSES.—The Finance Committee of the London County Council has agreed to make the following loans, *inter alia*, out of the Consolidated Loans Fund:—Bethnal Green, £46,500; Fulham, £30,000; and Stepney, £100,000. These are required for the extension of the electricity works of the Councils concerned.

Mansfield.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £5,750 in connection with the scheme for supplying electricity to the Rainworth and Sutton Road district.

Millom.—APPOINTMENT OF ENGINEER.—Mr. Stephen Corlett, M.I.M.E., M.I.E.E., of Wigan, has been appointed by the Urban District Council as the engineer for the Millom electricity supply scheme.

Morecambe.—LOANS SANCTIONED.—The Electricity Committee has received sanction to the following loans:—Building work, &c., £23,460; mains and services, £3,285 and £7,615.

Preston.—WIRING OF SMALL HOUSES.—At a meeting of the Town Council on April 30th it was reported that all the 202 municipal houses now being built would be wired for electricity supply, and 20 would be fitted with electric cookers and wash boilers as an experiment to ascertain as to how far it was possible to electrify at a cost, included in the rent, which would not make it prohibitive for working people.

INAUGURATION OF NEW POWER STATION.—Sir John Snell, chairman of the Electricity Commission, has accepted an invitation to perform the opening ceremony of the new Ribble power station on June 24th.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

WOLVERHAMPTON.—The percentage increases on general electricity supply by 16⅔ per cent., to 33⅓ per cent., above the pre-war rate.

STEPNEY.—The primary charges of 8d. per kWh for lighting and 4d. per kWh for power to be halved, but to be payable for 60 hours' instead of 30 hours' use per month of the maximum demand. For energy consumed beyond 60 hours' use of the maximum demand per month, the charge is to be reduced from 1½d. to 1d. per kWh for lighting, and from ¾d. to ½d. per kWh for power, heating, &c.

Rotherham.—ELECTRICITY IN BULK.—The Town Council has received from the Worksop Urban District Council an application for a bulk supply of electricity, negotiations with the Derbyshire and Nottinghamshire Electric Power Co. having fallen through. A sub-committee is to be appointed with the object of negotiating any necessary agreements with the borough of Retford, the Urban District Councils of Worksop and Gainsborough, and the Derbyshire and Notts. Electric Power Co. to carry into effect the sale of a bulk supply to any or all these authorities.

Sunderland.—STREET LIGHTING.—The Town Council is being recommended by its Highways and Electricity Committees to adopt a scheme for the lighting of the whole of the streets of the town by electricity. The cost of laying the mains, &c., is estimated to be over £100,000, and as the work will give employment to large numbers of unemployed men, a Government grant will be sought.

Sidmouth.—ELECTRICITY SUPPLY.—The Electricity Committee has instructed the manager of the electricity undertaking to ascertain the number of persons likely to use electricity if the cables are extended to Bickley Valley, and to report as to the cost of the work by the overhead and the underground systems.

LOANS.—Application is being made for sanction to loans of £2,000 for mains and services, and £1,250 to cover the cost of wiring 100 houses under the "free-wiring" system.

Tynemouth.—LOAN.—The Town Council is applying for sanction to the borrowing of £6,000 for sub-station equipment.

NEW SUB-STATION.—The Electricity Committee is to obtain a site at Billy Mill for a sub-station and store.

Ulverston.—LOAN.—The Urban District Council is applying for sanction to a loan of £11,668 for electricity purposes and to the Unemployment Grants Committee for a grant towards the cost.

United States.—HYDRO-ELECTRIC DEVELOPMENT.—According to *Power*, the Southern Power & Light Co., a newly-formed subsidiary of the Arkansas Power & Light Co., has applied for a preliminary permit covering a project at Colbert Shoals on the Tennessee River. This site is 11 miles below Muscle Shoals. It is proposed to construct a dam 45 ft. high near the town of Waterloo, and to install plant with a capacity of 100,000 h.p. This scheme is to form a part of an inter-connected system to cover Arkansas, Louisiana, and Mississippi, and is to be connected with the transmission lines of the Mississippi Power Co., the Louisiana Power Co., and the Arkansas Light & Power Co.

Workington.—INAUGURATION OF SUPPLY.—The electricity supply for the district was formally inaugurated by the Mayor on April 30th. Electricity is supplied from the Workington Electric Power Co.'s station at Siddock Colliery.

Tramway and Railway Notes.

Brighton.—TRACK RENEWALS.—The Tramways Committee has authorised the engineer to proceed with the renewal of the foundation and track in Wyke Road at a cost of £3,000.

The Committee has obtained the consent of the Ministry of Transport to the proposed laying of a double tramway track in lieu of the existing single line in Egremont Place and Upper Rock Gardens.

Chester.—RAILLESS CARS.—The Corporation Tramways Committee has instructed the tramway manager to prepare and submit to the next meeting of the Committee a report on the provision of (1) a system of railless cars, and (2) a municipal omnibus service.

Continental.—POLAND.—The Power and Traction Finance Co., Ltd., is financing the construction of a new electric tramway from Warsaw to Zdtrardow, a distance of 28 miles. The plans have been approved, and work will begin next month. The estimated cost of the scheme is £900,000.—*Reuter* (Warsaw).

BELGIUM.—La Société des Tramways Electriques de Gand has secured authority from the Government to construct a further electric tramway in the town of Ghent, which, when completed, will bring the system up to a length of 27½ miles.

Coventry.—NEW ROUTE.—The Tramways and Motor-Omnibus Committee of the City Council has recommended the Council to authorise the laying of a tramway along the Butts, Queen's Road, and Stoneleigh Terrace, at an estimated cost of £17,481.

Darlington.—RAILLESS CARS.—At a meeting of the Electricity and Tramways Committee, on April 24th, it was reported that as a result of an interview with the bodies who are opponents to the Corporation's Transport Bill, it was anticipated that arrangements would be made whereby the opposition would be removed. It is expected, therefore, that the new railless car system in the town will be in operation by next October. Tenders were provisionally accepted for 20 railless cars, with motors, at a cost of £30,000, and tenders were also accepted for alterations to the present overhead equipment.

Edinburgh.—NEW ROUTE.—A report dealing with a proposed new tramway route, between Newington Station and West End, *via* Melville Drive, has been approved by a sub-committee of the Tramways Committee.

Glasgow.—TRAMWAY EXTENSION.—The Tramways Committee has recommended that powers be sought for the extension of the tramway along Elizabeth Drive between Moss-park Boulevard and Paisley Road.

India.—RAILWAY ELECTRIFICATION.—The South Indian Railway has prepared a scheme, estimated to cost Rs.330 lakhs, for the electrification of the Madras suburban lines. The scheme is now under the consideration of the Home Board and will soon be submitted to the Railway Board for sanction.

It is understood that the report of Major R. H. Stallard, R.E., who had been appointed to investigate and report on the possibilities of the electrification of the suburban railway services of Calcutta, has been submitted to the Agent of the Eastern Bengal Railway.

London.—TRAIN-STARTING SIGNALS.—The Underground Co. has now completed the installation of bell signals for starting trains at all stations between Sloane Square and Mansion House (District Railway), and the scheme is shortly to be extended to stations eastward of Mansion House as far as Aldgate East. When the Mansion House to Aldgate section has been completed it is likely that further stations west of Sloane Square will be similarly equipped.

Manchester.—YEAR'S WORKING.—The accounts of the Corporation tramway undertaking for the year ended March 31st last, show a total revenue of £1,806,932, as compared with £1,843,042 in the preceding year. The number of passengers carried increased approximately from 294,000,000 to 312,000,000.

Southend-on-Sea.—RAILLESS CARS.—Railless, Ltd., of London and Rochester, has made arrangements with the Corporation for the loan of two single-deck railless cars of the new low floor type for the purposes of an experimental service on the Prittlewell route, and has received an order for the planning and supply of materials for the conversion of the overhead line. It is anticipated that the new service will commence operation shortly after Whitsun, and is to be run in conjunction with the existing tramway service for a period of several months.

Southern Railway Electrification.—According to *The Times*, as the final instalment of rearrangements arising out of the electrification of the South-Eastern railway system, track alterations are to be made next spring to the junction outside Cannon Street station. The junction will be taken up and replaced by a new one suitable for electric traffic. The work will commence during next March, and half of Cannon Street station at a time will be closed while the change is made. It is proposed to construct the whole set of new metals and test them out before they are set down near the station to which they will give access, and a piece of waste ground at New Cross has been chosen for the trial. The new junction has been planned, and, on that land will be constructed by the contractors under the supervision of the railway's engineers during the summer. This undertaking, together with the rebuilding of Cannon Street station, which the changed system will involve, is to cost £108,000. At the same time, the new method of signalling called the "speed-light" system, will be installed at the junction at a cost of £60,000. Similar undertakings on a smaller scale will be carried out at Holborn Viaduct and Charing Cross stations this year. That at the former will be completed by July, when the first part of the electrification—that to Orpington *via* New Beckenham and Penge—will be ready for use. Changes at Charing Cross will be completed by the end of the year. In both these cases the new signalling system will be installed, and £169,000 will be spent on the two schemes.

Telegraph and Telephone Notes.

Australia.—CABLE RATE.—It is announced that Press cable rates from Australia to the United Kingdom are to be reduced from 7½d. to 6d. per word.

The Telegraph Service.—The Central Telegraph Office is in direct daily touch with ships at sea covering a radius of 3,000 miles; about 70,000 telegrams daily pass outwards from, or homeward to, our shores. There are 2,000 telegraph messengers in London, and in London the public sends and receives from 15,000 to 18,000 telegrams by telephone per day. During the peak quarter hour (11.45 a.m. to noon) on one day 649 telegrams were received in one instrument hall from Great Britain and Ireland for delivery in London; 535 of them were handed in not earlier than the previous quarter of an hour, and more than one message per minute came from remote villages of fewer than 500 inhabitants.

The Telephone Service.—DEVELOPMENT.—The number of originated local calls in the United Kingdom during 1923-24 was 832 millions, an increase of 14 per cent. as compared with 1922-23. So far as trunk calls are concerned, the total for 1923-24 exceeded all previous records, the number of calls dealt with —69½ millions—being 18 per cent. higher than the total for 1922-23, hitherto the best year. The progressive growth of the inland trunk service is indicated by the number of calls in April of three successive years, *viz.*:—1922, 4,261,459; in 1923, 5,231,458; and in 1924, 6,118,959.

CALL OFFICES.—The total number of public call offices working at the end of December, 1924, was 18,605. The kiosk type of call office, accessible to the public day and night, totalled at the end of the year 931. The number of call offices in the Liverpool district is 830, including 100 kiosks.

Radio Notes.

France.—NEW RADIO-TELEPHONE STATION.—A new radio transmitting station, for telephony only, has been erected over the central post office at Toulouse. The aerial is seventeen metres above the roof, and the wavelength will be 450 metres. Satisfactory trials have already been made, and it is estimated that the station will have a radius of more than 1,000 kilometres. This station at Toulouse forms part of a scheme for a chain of posts, three of which, Paris, Lyons, and Marseilles, are already working; three others, Angers, Bordeaux, and Strasbourg, will be completed shortly.—*Reuter* (Paris).

Musician's Claims.—VALUE OF BROADCASTING.—As things are to-day, before an artist of any standing is permitted to broadcast he has to reckon not only with the gramophone companies (most of which are quite sympathetic), but also with concert promoters, many of whom are hostile to broadcasting. Mr. Cedric Sharpe points out, in a letter to the *Evening News*, that his own experience is that since he has broadcast, the sales of his gramophone records, and especially of the actual numbers broadcast, have increased by over one third. Ten months ago the Virtuoso String Quartet gave its first concert in the Wigmore Hall, and a second was given recently. In the interval the total bookings have quadrupled, and he is convinced that this result is the direct consequence of broadcasting and gramophone work.

Radio in Schools.—LANCASHIRE.—It is reported that the Lancashire Education Committee has refused to approve of any expenditure on radio equipment.

Germany.—THE RADIO INDUSTRY.—A communication regarding the situation and prospects of the radio industry in Germany has been made by Dr. Hamm, of Berlin, to a Frankfort newspaper. After the crisis of a year ago, which had the result of clearing away undesirable elements in the industry, the writer states that the firms remaining can be said to be of a lasting nature. Nevertheless, since the crisis, business has been subject to great fluctuations. The beginning of the past winter brought about a large increase in the sales, and at the Berlin Wireless Exhibition most firms sold out for some months forward, but those orders have for the most part been executed and the degree of activity has somewhat declined, although most firms continue sufficiently occupied. Dr. Hamm proceeds to say that a division of the production into complete apparatus and component parts is gradually being carried out. The prices for complete apparatus are much depressed and scarcely yield any profit to the makers. Merchants' expenses are very high, and they therefore require large discounts, which are about 50 per cent. normally. Instead of paying 330 marks for highly-sensitive apparatus, by purchasing the component parts amateurs are able to construct good apparatus with the best constituent parts in the market for less than 100 marks. With regard to the export trade, Dr. Hamm states that this branch could be profitable, as sale prices everywhere abroad are much higher, but the business is hampered by Customs walls and import vetoes.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Australia.—MELBOURNE.—June 3rd. Victorian Government Railways. Supply of 2,200-V cable and spares.

Ashton-under-Lyne.—May 20th. Watch and Town Hall Committee. Rewiring the electric light installation at the Town Hall. Specification from Borough Electrical Engineer, Electricity Works, Wellington Road.

Belgium.—May 20th. Belgian Post and Telegraph authorities at La Salle Madeleine, Brussels. Covered copper wire, cable, and cable accessories. Particulars (Cahier des Charges Special No. 3-102) for 7 fr. 65 c.

Bridlington.—May 14th. Electricity Department. Supply of two electricity feeders. (May 1st.)

May 20th. Electricity Department. Generator panel and switchgear for one 600-kW d.c. turbo-generator. (See this issue.)

Cardiff.—May 20th. Rural District Council. Switchgear equipment and e.h.p. and l.p. cables. (April 24th.)

Dublin.—May 21st. G.N.R. (Ireland). General stores for six months, including electric lamps, fittings cable and wire, &c. (See this issue.)

Dundee.—May 18th. Tramways Committee. Stores, including armature coils, commutators, mica, &c., insulated wire, lamps, switches, materials for overhead equipment, &c., for 12 months. Specifications from general manager.

Edinburgh.—May 13th. District Board of Control. Electric lighting and heating at new ward building, Bangour Mental Hospital. Schedules from Mr. Jas. D. Gibson, surveyor, 60, Frederick Street,, Edinburgh.

Egypt.—CAIRO.—July 1st. Public Works Department. Electrical pumping plant for a floating dock.*

June 24th. Egyptian State Railways, Telegraphs and Telephones. Supply of automatic telephones. Specification from the Inspecting Engineer's office in London.—*Reuter's Trade Service* (Cairo).

Erith.—May 11th. Urban District Council. L.p. cables. (May 1st.)

Gillingham.—May 9th. Electricity Department. Two 825-kVA. 3-ph. static transformers, two 11,000-V, 3-ph. mains, one regulating transformer, e.h.p. and h.p. 3-phase switchboard. (April 24th.)

Glasgow.—May 16th. Electricity Department. L.p. and e.h.p. cables, small i.r. cables and flexibles, meters, and carbons for 12 months. (May 1st.)

India.—May 22nd. South Indian Railway Co., Ltd. Electric overhead travelling crane. Specifications (5s.) from the company's offices, 91, Petty France, Westminster, S.W.

India Store Department. May 15th. Telephone cable and 25-kW oil-engine electric generating sets.

May 22nd. Carsack elements for Leclanché cells. (May 1st.)

Inverness.—May 15th. Town Council. Work in connection with the Bught hydro-electric scheme. Specifications by Geo. Gordon & Co., civil engineers, Inverness.

London.—BETHNAL GREEN.—May 20th. Electricity Department. One 1,000-kVA transformer. (See this issue.)

Liverpool.—May 13th. Corporation. Electric lighting installation at Coruwallis Street baths. Specification from Engineer and Superintendent of Baths, 75, Dale Street.

Manchester.—May 12th. Tramways Committee. Supply of block tin. Mr. H. Mattinson, general manager and chief engineer, Corporation Tramways, 55, Piccadilly, Manchester.

Morley.—Town Council. Electrician's work in connection with housing scheme in Middleton Road. Particulars from Mr. F. Turner, borough engineer, Town Hall.

New Zealand.—WELLINGTON.—July 7th. Post and Telegraph Department. Sub-station protectors.*

Plymouth.—June 5th. Electricity Department. One 1,500-kW converter. (See this issue.)

Raworth.—May 16th. Electricity Department. Paper-insulated cables, e.h.p. and l.p. switchgear, and transformers. (May 1st.)

Sidmouth.—May 18th. Electricity Department. 1,000 yd. l.p. overhead line. (See this issue.)

South Shields.—May 22nd. Electricity Department. Two groups of Scott-connected transformers, each 1,250 kVA. also h.p. switchgear. (May 1st.)

South Africa.—CAPE TOWN.—May 22nd. South African Railways and Harbours. Two electric goods lifts.*

JOHANNESBURG.—May 30th. Municipal Council. Street lamp fittings and electric lamps.*

Turkey.—CONSTANTINOPLE.—Post and Telegraph Department. Parts and chemicals for Leclanché cells.*

Uruguay.—MONTEVIDEO.—June 10th. State Electricity Works. Six aerial transformer sub-stations.*

July 20th. Administracion del Puerto de Montevideo. Two electric cranes.*

Wigan.—May 25th. Board of Guardians. One electrically-driven vertical pumping plant, heating and domestic hot-water supply apparatus, alterations to buildings, &c. (April 24th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Australia.—PERTH.—Western Australian Government. Following the remission of £44,000 duty on the electrical power plant extensions, the Government has accepted the following tenders for plant :—

12,500-kW turbo-alternator and accessories (£46,910).—C. A. Parsons & Co., Ltd.
Water-tube boilers and accessories (£9,140).—Babcock & Wilcox, Ltd.
E.h.p. and l.p. switchgear and control (£17,118).—Metropolitan-Vickers Electrical Co., Ltd. —*Melbourne Age.*

Darlington. — Electricity and Tramways Committee. Recommended :—

20 railless cars and motors (£30,000).—Clough, Smith & Co., Ltd.

Erith.—Urban Council. Accepted:—
In connection with the bulk supply from Woolwich :—

E.h.p. transformers (£10,622).—British Electric Transformer Co., Ltd.
E.h.p. switchgear equipment (£1,354).—Ferguson, Pailin & Co., Ltd.

Glasgow.—Electricity Committee. Recommended:—
Dalmarnock power station.

1,500-kVA transformer (£1,624).—Ferranti, Ltd.
"Diamond" soot blower for boiler house (£3,165).—Babcock & Wilcox, Ltd.

Great Western Railway Co.—Accepted:—

Cables, switchgear, and transformers for an electric distribution system at Barry Docks.—English Electric Co., Ltd.
Overhead contact wires and trolley arms for four movable coal hoists at Queen Alexandra Dock, Cardiff.—Brecknell, Munro & Rogers, Ltd.
Two electric luggage lifts for Maidenhead Station.—Hammond Bros. and Champness, Ltd.
Electric luggage lift for Tyseley Station.—Etchells, Congdon & Muir, Ltd.
Electric lighting installation at the new station at Coedeley.—Page and Stibbs.

Hull.—The Siemens & English Electric Lamp Co., Ltd., has received a tender for traction-type and gasfilled lamps for 12 months from the Corporation.

Ilford.—Electricity Committee. Recommended:—

Circuit breakers for Uphall Road and Goodmayes sub-stations (£115).—Whipp & Bourne.
500-kW automatic plant at Ganty Hill sub-station (£4,261).—Metropolitan-Vickers Electrical Co., Ltd.
Switchgear in connection with extension at Ley Street works and Goodmayes sub-station (£530).—General Electric Co., Ltd.
Public lighting transformers (£375).—Foster Engineering Co., Ltd.
Concrete slabs for e.h.p. feeder cable (£620).—Concrete Unit Co., Ltd.

Leeds.—Electricity Committee. Accepted:—

Cables.—£7,590, W. T. Henley's Telegraph Works Co., Ltd.; £2,659, Macintosh Cable Co., Ltd.; £1,512, Enfield Cable Works, Ltd.
Cable boxes.—£1,598, Tramway Supplies, Ltd.

Tramways Committee. Accepted :—

Joint welding plates.—Equipment & Engineering Co.
Electrodes.—Buckley, Saunders & Co., Ltd.
Copper bands.—British Insulated & Helsby Cables, Ltd.
Electrical sundries.—Electric & General Stores, Ltd.; Metropolitan-Vickers Electrical Co., Ltd.; L. Andrew & Co., Ltd.; Siemens & English Electric Lamp Co., Ltd.; and W. T. Henley's Telegraph Works Co., Ltd.

Leyton.—Urban Council.

Motor generator (£440).—Bruce Peebles & Co., Ltd.
Extension of existing contract for the supply of the balance of the two line cubicles at the Leyton Green sub-station (£687).—Hewittic Electric Co.

London.—LONDON COUNTY COUNCIL.—Mental Hospitals Committee. Electrical installations at the West Park Mental Hospital :—

	Lighting	Electrical equipment.
Cox-Walker & Partners. (Accepted.) ...	**£2,628**	**£304**
Electrical Installations, Ltd.	2,693	302
H. J. Cash & Co., Ltd.	2,713	425
Tyler & Freeman, Ltd.	2,341	1,153
Malcolm & Allan	3,091	626
Berkeley Electrical Co.	3,410	696

METROPOLITAN ASYLUMS BOARD.—Works Committee. Installation of c.b. telephone and fire alarm additions at the South-Eastern Hospital :—

W. H. Agar. (Recommended.) **£470**
Electrical Contracts & Maintenance Co. (1925), Ltd. 772

STEPNEY.—Electricity Supply Committee. Recommended :—

One 25-kVA transformer for Limehouse generating station (£56).—Hackbridge Electric Construction Co., Ltd.
One portable air-compressor road breaker (£574).—Reavell & Co., Ltd.
50 tons pitch (£127).—Forbes, Abbott & Lennard, Ltd.
2 tons plumber's solder (£179).—G. Pizey & Sôn.
27,000 tons of Scotch washed peas and Blairhill washed nuts and smalls (during 12 months ending April, 1926) (19s. 6d. per ton).—W. Cory and Son, Ltd.
20,000 to 25,000 tons of Wemyss Scotch washed peas (19s. 3d. per ton) (during 12 months from July 1st next).—E. Foster & Co.

Manchester.—Electricity Committee. Recommended:—

33,000-V and 6,600-V switchgear.—Ferguson, Pailin, Ltd.
3-phase induction regulators.—Metropolitan-Vickers Electrical Co., Ltd.

Salford.—Electricity Committee. Accepted:—

One 1,500-kW rotary converter and switchgear (£5,711).—Metropolitan-Vickers Electrical Co., Ltd.
33,000-V switchgear (£15,557); extension of e.h.p. cubicles (£334).—Ferguson, Pailin, Ltd.
One "Sunic" d.c. cable-testing equipment (£707).—Salford Electrical Instruments, Ltd.

Forthcoming Events.

Physical Society of London.—Friday, May 8th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Ordinary scientific meeting.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, May 9th. At the Grand Hotel, Port Talbot. At 3.30 p.m. Annual general meeting.

National Association of Supervising Electricians.—Tuesday, May 12th. At St. Bride's Institute, E.C. At 7.15 p.m. Lecture on "Private Telephone Exchanges," by Mr. G. Hurford.

Institution of Electrical Engineers (Irish Centre, Dublin).—Thursday, May 14th. At Trinity College, Dublin. At 7.45 p.m. Ordinary meeting.

Royal Institution of Great Britain.—Friday, May 15th. At 21, Albemarle Street, W. At 9 p.m. Lecture on "Recent Developments in Magnetism," by Prof. C. G. Darwin, F.R.S.

Notes.

British Engineering Standards Association.—The Main Committee at its last meeting appointed Mr. C. P. Sparks, C.B.E., to be chairman of the Sectional Electrical Committee in succession to Mr. C. H. Wordingham. This Committee is charged with the work of electrical standardisation, and has 79 sub-committees and panels. Mr. Sparks's close association with the work of electrical standardisation dates back for a long period. He is one of the representatives of the Institution of Electrical Engineers on the Main Committee of the B.E.S.A., and for many years has been chairman of one of its most important sub-committees.

The Shannon Hydro-Electric Scheme.—The Shannon Electricity Bill, the first of the measures authorising the Irish Free State Government to proceed with the scheme, already approved, for the harnessing of the River Shannon for electrical purposes, was introduced in the Dail (Lower House of Parliament) last week (May 1st), and has since passed rapidly through other stages. It is expected to become law forthwith, as the Senate will not delay in dealing with it.

There are 19 clauses in the Bill. The first defines the general powers of the Minister of Industry and Commerce. It enables him "to impound, hold up, divert, take, and use the waters of the River Shannon, or any tributary stream or river as he may think proper."

The second section gives the Minister the right to acquire lands, premises, or fishing rights compulsorily, and to interfere with public or private roads, bridges, ways, or canals.

According to the fifth clause of the Bill, the amount of compensation to be paid for lands or premises thus compulsorily acquired, or for the canals or rights of way interfered with, is to be fixed in accordance with the Acquisition of Land Act, 1919.

The sixth section of the Bill provides for the establishment of a tribunal to fix prices or compensation. Other clauses authorise the Minister to delegate to any local body his power of ordering the construction of railroads or tramways, enable him to improve the navigation of the Shannon or any tributary of it, and authorise him to drain lands adjacent to the Shannon. Such sums as may be required for the purpose of the undertaking—authorised by this particular Bill—are to be advanced out of the Central Fund.

Under Section 13 the Minister is empowered to contract for the supply—on such terms as he thinks proper—to any person of "any quantity of electricity produced by the undertaking.

Under a further section lands benefited by drainage under the scheme will be liable for certain payments, to be determined by arbitration.

The last two clauses make provision for the protection of fisheries and postal and telegraphic services.

A second, and supplementary, Bill relating to the Shannon scheme will be introduced later. It will deal with organisation in detail, and will, therefore, be of a very comprehensive character.

It is understood that, under the first Bill, the Government will be able to appoint a special staff of engineers to act in an advisory capacity, and that the position of engineer-in-charge will be given to Professor F. S. Richworth, University College, Galway.

There is still an urgent demand on Mr. MacGilligan, Minister of Industry and Commerce, for details as to plans, &c., of the Shannon scheme, and public feeling in the Free State appears to insist that these details should be disclosed before legislation is finally passed.

Educational.—THE POLYTECHNIC, REGENT STREET, W., ELECTRICAL AND ENGINEERING DEPARTMENT.—A special course of six lectures on "The Thermionic Valve and its uses in Wireless Circuits," by Capt. W. H. Date, is to be given on Tuesdays, commencing May 19th, from 6.30 to 8.30 p.m. Further particulars on application to the Director of Education.

MANCHESTER MUNICIPAL COLLEGE OF TECHNOLOGY.—The Governing Body of the College announce the offer of a scholarship of the value of £50 per annum for three years, tenable in one of the University Engineering Courses in the College of Technology. Particulars from the Registrar of the College. (See our advertisement pages to-day.)

Crosby Feed Regulators.—With reference to the description of the Tunbridge Wells power station in our April 17th issue, we understand that the automatic boiler feed water regulators fitted are of the latest type supplied by the Crosby Valve & Engineering Co. with loose copper heating surface, which is the subject matter of two recent patents. This type of regulator is also being fitted to the five Yarrow boilers at the Barking generating station, dealing with a working pressure of 475 lb. per sq. in. The hot well "Hydrokimiter mentioned in the article is provided with a "Sylphon" temperature recorder, which maintains an even temperature at 120 degs. for which Messrs. Crosby are the sole European agents.

Municipal Trolley Vehicles and Tubes Suggested for London.—The estimates for the financial year 1925-26 were to be submitted at last Tuesday's meeting of the London County Council and amendments to the resolution approving these were set down by a number of members. One, to be moved by Mr. Morrison, suggested the consideration by the Finance and Parliamentary Committees of the submission of a supplementary maintenance estimate of £500 in respect of the promotion of legislation to empower the Council to own and operate petrol and trolley omnibuses. An amendment submitted by Mr. A. Baker was in the following terms:—"And that it be referred to the Finance and Parliamentary Committees to consider and report as to the submission of a supplemental maintenance estimate of £500 in respect of the promotion of legislation to empower the Council to own and operate tube railways, having regard to the shortage of tube travelling facilities in the eastern, north-eastern, and south-eastern districts of London."

Electrical Development at Walthamstow.—A local Industries Exhibition was held last week at the Drill Hall, Walthamstow, under the auspices of the Chamber of Commerce. Evidence of increasing public interest in local exhibitions is shown by the fact that the attendance exceeded four thousand persons per day. Great credit is due to Mr. G. R. Spurr and his assistant, Mr. Gilbertson, for the exceptionally comprehensive electrical display, which attracted very considerable attention and more than a thousand definite inquiries regarding lighting, cooking, heating and power.

A special feature of the Electricity Department's stand was a side window complete with white and amber concealed lighting units and spot light projectors, supplemented by "Super-Victor" lanterns for outside lighting. The general lighting of the stand consisted of a double colour scheme with additional alabaster, silk, bowl and other modern fancy fittings. Continuous cookery demonstrations were carried out on a "Tricity" cooker, two special milk-cooking demonstrations being organised by the National Milk Publicity Committee in co-operation with Miss Kidner and Miss Cavanagh of the Good Housekeeping Institute. It is interesting to note that it was originally intended that these demonstrations should be carried out by gas and that they were transferred voluntarily to the electricity stand on account of the considerable interest aroused in connection with electric cookery.

The general electrical exhibits included a "Creda" miniature cooker and grill; "Belling" grills; a "Heatrae" 20-gallon geyser; a 12-gallon wash boiler, bringing 10 gallons of water from cold to boiling in 60 minutes; "Hobart" cake mixers, meat choppers, and coffee mills; "Universal" vacuum cleaners; "Xcel" fires and irons; "Electricoal" fires; "Siemens" coffee percolators; "Heatrae" whistling kettles; a Singer electric sewing machine; and vibro-massage and violet-ray outfits, hair dryers, &c.

The Electricity Department has instituted a popular assisted wiring scheme, providing and maintaining wiring and accessories on a rental basis of 4s. per quarter for each £10 expended, the hirer purchasing and maintaining such fittings, shades and lamps as may be required to complete the installation. All the wiring is carried out by local contractors. Radiators and motors can be hired on very favourable terms, and a special domestic two-part tariff is in force.

Other electrical exhibits at the Local Industries Exhibition included a display of a.c. and d.c. motors and starters, and some oil- and air-cooled transformers by the Swedish General Electric Ltd.

Messrs. Biggs, a firm of local contractors, also had a very good display of general lighting fittings, colour-sprayed lamps, "Dayanite" and "K.F.M." signs, fires, fans and radio apparatus.

Birmingham Electrical Golfing Society.—The Spring Competition will be held on the Sandwell Park links on Monday, May 25th, for the Electrical Trades Challenge Cup. The Society was formed in 1911, and holds three meetings each year. We are asked to state that the Committee extends a cordial invitation to golfers in the Midlands electrical industry to enter these competitions. Full information will be gladly supplied by the Hon. Secretary, Mr. W. A. Millinger, 9, Livery Street, Birmingham.

The Hunt Self-Paralleling Alternator.—On Friday last week an interesting demonstration took place at the Leckhampton quarries near Cheltenham, of the remarkable self-paralleling properties of the new type of alternator designed by Mr. L. J. Hunt, the consulting engineer. The object of the tests was to show that the new machines will run in parallel, and continue to do so, under conditions which would render the parallel operation of existing patterns of alternators impossible. It is hoped to publish details and winding diagrams shortly.

The Halifax Electricity Dispute. — The protracted electricity dispute at Halifax has taken on a new aspect as a result of the proposed linking up of the Corporation's undertaking with Huddersfield. In March, 1923, following correspondence with the Electrical Power Engineers' Association respecting salaries, the Halifax Electricity Committee dismissed its technical staff and appointed a new one. In a long letter to the Halifax authority, Mr. W. A. Jones, general secretary of the E.P.E.A., points out that although the Corporation has reverted to the arrangements in operation prior to the dispute, it has refused, so far, to reinstate "those employés whom they unjustly dismissed in 1923 after long and faithful service." The installation of a trunk main between Halifax and Huddersfield would necessitate certain technical co-operation between members of the E.P.E.A. in the Huddersfield undertaking and the technical staff at Halifax, and while the dispute with Halifax remained unsettled, the E.P.E.A. members at Huddersfield would refuse to accept any responsibility for the operation of the trunk main. "This trunk main is but an initial step towards the linking up of other undertakings in the area, and I have to emphasise that the feelings and opinions of our Huddersfield members on this question are shared and supported by our members on other undertakings, such as Leeds, Bradford, and the Yorkshire Electric Power Co. The Association therefore desires that the parties that may be affected should appreciate that the non-settlement of the dispute is tending to impede not only the development of the Halifax undertaking, but may also seriously affect the development of neighbouring undertakings." No action has so far been taken by Halifax. Copies of the communication have been sent to the Electricity Commissioners and the Huddersfield Corporation.

Electricity at a Walthamstow Exhibition.

Gas and Electricity.—In a letter to the *Gas World* of May 2nd. Mr. A. Hugh Seabrook gives the following instances of combined gas and electricity supply undertakings in this country:—"The Crowborough Gas Company put its electricity Act into force, and is now running a combined gas and electricity undertaking. The Swanage and Oakham Gas Companies obtained Electricity Acts, and both those companies are now running combined gas and electricity undertakings. The Port Talbot Corporation has placed contracts for electricity plant, to be erected in its gasworks, the two undertakings to be run together. Spalding Urban District Council is about to call for tenders for plant to do the same thing. Retford Corporation is only waiting the consent of the Electricity Commission to carry out the scheme. The Horley Gas Co.'s

Electricity Bill was reported fully in the technical Press just recently. There are several other cases that are not sufficiently advanced at the moment to mention; there are several combinations of gas and electricity that I have not been concerned in, and there are various committees working on the subject with a view to carrying out the work on a larger scale."

Colliery Power Supply Problems.—CORRECTION.—In the abstract of Mr. J. F. Perry's paper on the above subject in our April 24th issue, an unfortunate error occurred in Table I on p. 675, "Scheme a" and "Scheme b" having been reversed. The cheaper scheme is the Stubbs-Perry installation.

Appointments Vacant.—Assistant telegraph engineer, for the Government of the Gold Coast; junior shift engineer, for the Burnley Corporation electricity department; chief designing engineer, for the Hackbridge Electric Construction Co., Ltd.; technical assistant and junior technical assistant, for the R.A.F. Establishment South Farnborough; fitter driver, for the Severalls Mental Hospital, Colchester. (See our advertisement pages to-day.)

Conference of Women in Science and Industry.—A three days' conference has been convened by the Women's Engineering Society in co-operation with the British Federation of University Women, the Industrial Welfare Society, the Institute of Industrial Welfare Workers, the National Union of Scientific Workers, the Standing Joint Committee of Industrial Women's Organisations, and the Women's Electrical Association. The Duchess of York has consented to become President of the Conference and to attend the opening session on July 15th, which will be called Women's Industrial Day. Exhibitors are giving a special display of women's work on this occasion.

Amongst those speaking on the opening day will be:—The Hon. Lady Parsons (Engineering), the Viscountess Rhondda (Commerce), and Miss Ellen Wilkinson, M.P. (Industrial Organisation). The two following days will be devoted to papers by women experts on such subjects as engineering, chemistry, industrial welfare, factory inspection, and commerce. The following papers have been promised:—Automotive Research (Miss Ethel Bailey, America) The Effect of Welfare Work on Health and Efficiency (Miss C. U. Kerr), The Place of the Wholesaler in the Scheme of Distribution (Miss L. F. Nettlefold, LL.B.), Salesmanship (Miss G. Burlton), Domestic Application of Electricity (Miss M. Partridge, B.Sc.).

In connection with the conference a large Advisory Council has been formed of prominent men and women industrialists, scientists and engineers. The social side has not been neglected, and a reception and dance are being arranged.

Faraday House Old Students' Association.—The annual smoking concert of this Association was held at the Hotel Cecil on May 1st, Mr. H. W. H. Richards, M.I.E.E. (F.H. 1905-9), the president, being in the chair. There was a large attendance, and the excellent programme of music was much appreciated. Mr. H. W. Swann (F.H. 1902-5), H.M. Electrical Inspector of Factories, proposed a vote of thanks to the chairman, which was enthusiastically carried.

Old Centralians.—An informal luncheon, at which between 30 and 40 old students of the City and Guilds Engineering College were present, was held at the Old Colony Club, Aldwych, W.C., on March 30th. It was arranged to hold similar luncheons regularly at the club on the third Tuesday in every month, the next luncheon to be held on May 19th. All old students of the College who are interested are requested to communicate with the Hon. Assistant Secretary, Mr. W. Simonson, 18, Quentin Road, Lee, S.E.13.

Local Societies.—THE EDINBURGH ELECTRICAL SOCIETY.—The series of lectures for the session concluded on April 24th, when Mr. J. Walker, of the Walker Electrical Service, gave an illustrated lantern lecture entitled "Electrical Workshop Experiences."

BRADFORD ENGINEERING SOCIETY.—Mr. W. B. Woodhouse, president of the Institution of Electrical Engineers, was the chief guest at the annual dinner of the Society on May 2nd. Other guests were the Lord Mayor of Bradford (Mr. J. H. Palin, M.P.), Mr. P. J. Pybus, managing director of the English Electric Co., Ltd., the President of the Bradford Chamber of Commerce, and Principal H. Richardson, head of the Bradford Technical College, which has a large electrical engineering department.

The British Institute of Philosophical Studies.—We have received from Mr. E. Garcke a brochure explaining the objects and constitution of the Institute, which was recently formed in London "to bring leading exponents of the various branches of philosophy into direct contact with the general public." The Council comprises over a hundred men and women of the first standing in letters, science, engineering, industry, commerce, and politics, amongst whose names are those of Lord Ashfield, Mr. H. B. Atkinson, Sir Robert Hadfield, Mr. W. L. Hichens, Sir Joseph Larmor, Sir Lynden Macassey, Sir Charles A. Parsons, Mr. A. A. Campbell Swinton, Sir J. J. Thomson, and Sir Alfred Yarrow. Mr. E. Garcke is the hon. treasurer, and, we believe, the originator of the Institute.

"On all matters outside a small familiar world, a man without a tincture of philosophy possesses no comprehensive principles to guide him, and consequently is liable to be the victim of prejudices. Philosophy supplies us with a method of approach to the problems of life and with principles of direction."

It is proposed to inaugurate courses of lectures, more or less of a popular kind, lectures to serious students, and lectures to specialists in science, besides forming a philosophical library, encouraging research, and holding conferences. The subscription is one guinea per annum (10s. only till April 1st, 1926).

Electricity in Agriculture.—During the week-end—from May 9th to 11th, inclusive—the annual general meeting of the German Society of Engineers will take place, at Augsburg. Amongst the special features of the congress will be a paper by Prof. Nägel, of Dresden, on research in the United States, and one on the applications of machinery to agriculture by Herr Pöppelmann, of Augsburg, the first president of the Agricultural Machine Society, which will demonstrate that the problems of agriculture generally represent the most essential factors in German economics.

National Illumination Committee of Great Britain.—The report of the Committee, presented at the annual meeting on January 29th, 1925, for the year 1924, was sent to us last week. It gives the decisions arrived at as a result of the meeting of the International Commission on Illumination at Geneva, in July last year, and the subjects which are being investigated by Committees since appointed by the Commission. A Sectional Committee on Illumination has been appointed by the British Engineering Standards Association, the nucleus of which is the British National Committee, to which 12 representatives of Government departments, manufacturers' associations, and technical institutions have been added. Five sub-committees have been set up.

Institution Notes.

Institution of Electrical Engineers.—WESTERN CENTRE.—*Summer Meeting.*—The summer meeting of the Centre will be held at Dursley on May 22nd, 1925. Charabancs will convey members and lady friends (who it is hoped will be present in large numbers) from the railway stations at Gloucester to Messrs. R. A. Lister & Co.'s works at Dursley.

SCOTTISH CENTRE.—*Annual Outing.*—Members of this Centre visited Dundee on April 24th. In the afternoon a meeting was held in the Technical College, at which Mr. Alexander Lindsay, chairman of the Centre, presided, when Mr. A. B. Mallinson read a paper entitled "Justifiable Small Power Plant." There was a good attendance, and the paper elicited a keen discussion. In the evening, on the invitation of the Lord Provost and magistrates of Dundee, members attended a reception in the Victoria Art Galleries. On Saturday a party of members and friends, including ladies, numbering about 60, motored to Edzell, where they lunched together, and time was allowed for a round at golf or for a short ramble in the neighbourhood. The return trip was made *via* Brechin, Arbroath, and Carnoustie, where tea was served.

NORTH-EASTERN CENTRE.—*Annual Meeting.*—The annual meeting of this Centre was held at Newcastle-on-Tyne on April 27th, when the following officials were elected:—Chairman: Mr. R. W. Gregory (Messrs. Merz & McLellan); vice-chairmen: Mr. J. Rosen (Messrs. C. A. Parsons & Co., Ltd.) and Mr. Hugh Paterson (Metropolitan-Vickers Electrical Co., Ltd.); hon. secretary: Mr. P. J. Allan (Macintosh Cable Co.); ordinary members of committee: Mr. F. G. C. Baldwin (Engineering Department G.P.O., Newcastle); Mr. B. H. Leeson (Messrs. A. Reyrolle & Co., Ltd.); Mr. A. H. W. Marshall (Newcastle-on-Tyne Electric Supply Co., Ltd.); Mr. R. E. Robson (Messrs. Robson & Coleman); and Mr. C. W. Salt (city electrical engineer, Carlisle).

Society of Engineers (Incorporated).—At the meeting held on May 4th, Mr. R. C. S. Walters, B.Sc., read a paper on "The Water-power Exhibits at the British Empire Exhibition, 1924." The paper reviews the water-power resources of the British Empire, and the way these resources have been developed, in some countries, under the auspices of certain commissions and water-power boards which co-ordinate the power requirements of the particular individuals or towns with the interests of the country taken *as a whole*. Some of the methods of financing the schemes are dealt with, and short descriptions are given of some of the more important hydro-electric schemes in operation or under construction.

Royal Institution.—The annual meeting of the members was held on May 1st, when the annual report of the Committee of Visitors for the year 1924, testifying to the continued prosperity and efficient management of the Institution, was read and adopted. The report of the Davy Faraday Research Laboratory Committee was also read. Seventy-eight new members were elected in 1924, and 63 lectures and 19 evening discourses were delivered. Amongst the officers elected for the ensuing year were the following:—President: The Duke of Northumberland; treasurer: Sir James Crichton Browne; secretary: Sir Arthur Keith.

At a meeting of the members on May 4th, Sir J. J. Thomson was re-elected Honorary Professor, and Sir Ernest Rutherford Professor of Natural Philosophy.

Junior Institution of Engineers.—PUMPS AND PUMPING PROBLEMS.—On May 1st, Mr. A. A. Fairfax delivered a lecturette on the above subject, in the course of which he described several kinds of rotary and deep-well pumps, and the circumstances in which they worked best. He said that in spite of the numerous designs of rotary pumps running at 200 or 300 r.p.m., there was still a need for a universal rotary pump with a positive action which could be coupled direct to an electric motor running at 2,000 r.p.m.

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Mr. D. N. DUNLOP, Director of the B.E.A.M.A., is one of the candidates nominated for a seat on the Council of the London Chamber of Commerce, which holds its annual meeting on May 13th.

Dr. CHARLES CHREE, F.R.S., retired on Tuesday from the office of Superintendent of Kew Observatory, which he has held for 32 years. He is succeeded by Mr. F. J. W. Whipple.

Mr. J. C. DENISON-PENDER, at present joint managing director of the Eastern Telegraph Co., has been appointed, in addition, vice-chairman of the company. He also has been appointed vice-chairman of the Eastern Extension, Australasia and China Telegraph Co., of which he is already a director. Vice-Admiral GRANT, C.B., joint managing director with Mr. Pender of the Eastern Telegraph Co., has been elected to a seat on the board of the Eastern Extension Co.

Mr. E. STEER HODSON, secretary of the Western Telegraph Co., retired at the end of April, and Mr. F. H. TARVER, assistant secretary, has been appointed secretary.

In the list of Foreign Decorations, for the wearing of which His Majesty the King has lately given authority, the "Order of the Excellent Crop" (Fifth Class) is mentioned as authorised to be worn by Mr. CLAUDE SINCLAIR TAYLOR, of the Shanghai Municipal Electric Department.

The Finance Committee of Northampton Town Council recommends that the salary of the tramway manager, Mr. J. F. CAMERON, be increased from £684 to £700 per annum.

Mr. E. W. DICKINSON, chief engineer at the Greenwich power station of the London County Council, who recently retired after over 20 years' service, was on April 29th presented by the officials and staff with a roll-top desk, a case of English drawing instruments, and a silver cigarette case, together with a handbag for his wife.

The L.C.C. Highways Committee recommends the promotion of Mr. J. J. MCGREGOR, A.M.I.E.E., assistant power station engineer in the electrical branch of the tramway department, to the position of power station engineer, rendered vacant by the retirement of Mr. E. W. Dickinson, at a salary of £801 rising by two annual increments to £914.

Mr. J. ALLAN has resigned his position of station superintendent at the West Ham Corporation generating station.

A dinner was given by the officers and warrant officers on April 30th at the Florence Restaurant, London, in honour of Lieutenant-Colonel K. W. E. EDGCUMBE, T.D., M.Inst.C.E., M.I.E.E., R.E. (T.A.), on his resignation of the command of the 27th Anti-Aircraft Battalion R.E. (T.A.) (London Electrical Engineers). Lieut.-Colonel Evans, O.B.E., in proposing the toast of the evening, drew attention to Colonel Edgcumbe's long association with the Volunteers and Territorial Army, a matter of close on 30 years, and his services in particular to the unit. The toast was seconded by the Regimental Sergeant-Major, Mr. A. B. Penney, R.E.

It will interest Masonic readers to know that W. Bro. J. SNOW HUDDLESTON has been appointed to Grand Rank, having been invested on Wednesday last week as Past Assistant Grand Director of Ceremonies.

The Industrial Australian reports that Mr. R. D. ELLIOTT, chairman of Armstrong, Whitworth Pty., Ltd., was to leave for England by the R.M.S. *Oronsay* on April 7th. He is visiting London to consult with the parent organisation, Sir W. G. Armstrong, Whitworth & Co., Ltd., in matters affecting the extension of this company's activities in Australia.

Mr. J. E. PEARCE, senior engineer-in-charge at Hammersmith Council Electricity Works, was last week the recipient of a gold watch from the staff and employés of the station. Mr. F. Hill, chief engineer and manager, in making the presentation, expressed his regret at losing the services of Mr. Pearce (after 23 years' work), and wished him success with his new employers, the Vickers & International Combustion Engineering, Ltd. Mr. S. Farmer spoke cordially on behalf of the men engaged in the engine room and boiler houses, and Mr. Pearce responded.

MR. HERBERT C. SIDDELEY has been appointed the London and export sales manager of the National Gas Engine Co., Ltd., succeeding Mr. C. P. King, who has retired after many years' service with the company.

Mr. J. W. SPARK, M.I.E.E., of West Hartlepool, has been appointed city electrical engineer of Bath.

Mr. H. JENNINGS, late assistant electrical engineer, Indian Ordnance Department, has been appointed electrical engineer to the P.W.D. to the Crown Colony of Gambia. He sailed from Liverpool on May 2nd.

Obituary.—MR. H. MATTY.—The death occurred at Newton Abbot recently of Mr. Harry Matty, who, joining the Electric Telegraph Co. in 1863, became assistant superintendent of telegraphs in 1899, and subsequently postmaster of Newbury, retiring from the service to Newton Abbot in 1909. Mr. Matty was 73 years of age.

MR. J. K. PATERSON.—The death took place with tragic suddenness at the annual meeting at Edinburgh of the Scottish Federation of Master Plumbers and Domestic Engineers' Employers' Federation of Mr. John Keppie Paterson, J.P., senior partner of the firm of Messrs. Paterson & Sons, plumbers and electricians, Elm Row, Edinburgh. Mr. Paterson, who had been elected president of the Federation, was about to open the afternoon session when he collapsed.

Major J. A. CHISHOLM.—*The Times* records the death in London, at the age of 59 years, of Major James Alexander Chisholm, "late Eastern Telegraph Co.," and for many years secretary of the Highland Society of London.

MR. A. W. GILLESPIE.—News has been received of the death at New York of Mr. Alex. W. Gillespie, formerly of Ayr. Mr. Gillespie was in the service of the International General Electric Co.

MR. J. W. BAKER.—The death is reported of Mr. James Walter Baker, aged 77 years, who was appointed secretary to the Blackburn Tramway Co. in 1893, and held this position after the enterprise was taken over by the Corporation, until 1911.

MR. D. B. MORRISON.—We regret to note from the *Financial Times* that Mr. D. B. Morrison, who retired from the chairmanship of Messrs. Richardsons, Westgarth & Co., Hartlepool, at the end of last year, has passed away at Nice at the age of 66 years.

MR. E. BLYTHE.—The death occurred on the 3rd inst., at the age of 43 years, of Mr. Edward Blythe, who was for 21 years chief draughtsman in the Hull Corporation Electricity Department.

Wills.—The late Mr. G. F. BONNOR (formerly Metzger) left £6,385 gross and £1,100 net personalty.

MR. ARNOLD HENRY WHITE, who died in February at the age of 77, and is described as at one time "Secretary of the Edison Electric Lighting Co.," left £2,534 gross and £303 net personalty.

New Companies Registered.

Lumos Radio Valve Co., Ltd. (205,611).—Private company. Registered April 30th. Capital, £1,000 in £1 shares (250 5 per cent. cumulative preference and 750 ordinary). Objects: To acquire the business of manufacturers of and dealers in radio receiving and transmitting valves, sets and other apparatus, electric lamps, vacuum tubes, X-ray apparatus, chemical and scientific glass and glass apparatus, accumulators and accumulator charging carried on by J. J. Minson and E. C. Goman at 64, Mill Hill Road, Acton, W. The directors are:—J. J. Minson, 9, Highlands Avenue, Acton, W.3; E. C. Goman, 44, Leghorn Road, Harlesden, N.W.10. Qualification, £1. Solicitors: W. A. G. Davidson & Co., 40, Chancery Lane, W.C.2. Registered office: 64, Mill Hill Road, Acton, W.3.

De Leeuw & Co., Ltd. (205,600).—Private company. Registered April 30th. Capital, £500 in £1 shares. Objects: To carry on the business of general agents, dealers in electrical appliances, automobile and radio appliances, motor cars and motors, general merchants, electricians, mechanical and marine engineers, and manufacturers, workers and dealers in electricity, &c. The subscribers (each with one share) are:—H. de Leeuw, Sentinel House, Southampton Row, W.C., sales director; W. R. White, Sentinel House, Southampton Row, W.C., sales director. The first directors are not named. Qualification, one share. Secretary: W. R. White. Solicitors: Arthur Hunt & Money, 24, Haymarket, S.W.1. Registered office: Sentinel House, Southampton Row, W.C.

Electrical Displays and Accessories, Ltd. (295,586).—Private company. Registered April 29th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of factors and manufacturers of and dealers in electrical and mechanical signs and motors, advertising devices, gramophones, wireless, and radio-active appliances, &c. The directors are:—E. A. Chew, 33, Westborough Road, Westcliff-on-Sea, accountant; P. E. Hedges, 2a, Southfield Road, Oxford, cashier; T. P. Stanbank, 26, Marloes Road, Kensington, W.8, company director. P. E. Hedges and T. P. Stanbank are joint managing directors. Qualification, £25. Remuneration as fixed by the board. Registered office: 37, Piccadilly, W.1.

Andia, Ltd. (205,575).—Private company. Registered April 29th. Capital, £25,000 in £1 shares. Objects: To acquire from Don Gabriel G. de Andia Yrarrazaval, of Paris, the registered trade mark "Andia" and the benefit of certain existing inventions and patent rights relating to sound reproducing and amplifying apparatus, &c. The directors are:—C. A. Lowenadler, Grenabo, Highbury Road, Wimbledon; E. A. M. Welin, Brook Lodge, Stock, Essex; and G. C. de Andia Yrarrazaval, 118, Rue de la Faisanderie, Paris. So long as the said G. G. de Andia Yrarrazaval holds 5,000 shares he may appoint two directors, one of whom may be himself. Remuneration as fixed by the company. Secretary: E. W. Elliot. Solicitors: Smiles & Co., 15, Bedford Row, W.C.1. Registered office: 4, Fenchurch Avenue, E.C.

C. Seward & Co., Ltd. (205,580).—Private company. Registered April 29th. Capital, £10,000 in £1 shares. Objects: To acquire the business of heating and ventilating engineers carried on by Thomas Blackburn & Sons, Ltd. (trading as C. Seward & Co.) at Preston; to adopt an agreement between the said company and J. H. Hibbert; and to carry on the said business and that of electrical engineers, makers of electric motors, motor engineers, manufacturers of motors, &c. The subscribers (each with one share) are:—A. R. Whitlock, Lymehurst, 72, Victoria Road, Fulwood, Preston, engineer; and J. H. Hibbert, Homestead Bungalow, Penwortham, Preston, commercial director. The permanent directors are: A. R. Whitlock (managing director), T. Blackburn, and J. Blackburn, addresses not stated. Qualification, £50. Remuneration as fixed by the board. Solicitors: Jaques & Co., 8, Ely Place, E.C.1.

Bective Electrical Co., Ltd. (205,507).—Private company. Registered April 25th. Capital, £3,000 in 50 6 per cent. cumulative preference shares of £50 each and 4,000 ordinary shares of 1s. Objects: To carry on business as electrical engineers and contractors, suppliers of electricity, manufacturers of and dealers in electric, magnetic, galvanic, wireless and other apparatus, &c. The directors are:—The Earl of Bective, 36, Cumberland Mansions, W. (chairman); T. A. Hulance, "Kingstone," Warwick Road, Sutton; E. J. Clarke, 35, Creighton Avenue, Muswell Hill, N., building manager. The Earl of Bective and T. A. Hulance are joint managing directors. Qualification, 1 ordinary share. Remuneration (except managing director) as fixed by the company. Secretary: M. Andrews, 4, High Street, Sutton. Solicitors: Jaques & Co., 8, Ely Place, E.C.1.

Tyne Autos, Ltd. (205,555).—Private company. Registered April 27th. Capital, £2,000 in £1 shares. Objects: To carry on the business of electrical, motor and general engineers, contractors and general outfitters and manufacturers, &c. The subscribers (each with one share) are:—A. S. Liddal, junr., 37, Grosvenor Place, Newcastle-on-Tyne, accountant's clerk; R. J. Silburn, 37, Manor House Road, Newcastle-on-Tyne, solicitor. The first directors are to be appointed by the shareholders. Qualification, £100 shares. Remuneration as fixed by the company. Secretary: A. S. Liddal, junr. Solicitor: H. G. Lester, 24, Grainger Street West, Newcastle-on-Tyne.

Guest, Keen & Piggotts, Ltd. (205,515).—Registered as a private company on April 25th with a nominal capital of £40,000 in £1 shares (35,000 7 per cent. cumulative preference). Objects: To adopt an agreement dated January 29th, 1925, between Guest, Keen & Nettlefolds, Ltd., and Thomas Piggott & Co., Ltd., and to carry on the business of manufacturers and factors of and dealers in mains, pipes, conduit, poles, wires, containers and vessels of all kinds for conveying, transmitting, storing, measuring and otherwise utilising water, gas, oil, electricity or otherwise, manufacturers and drawers of tubes and pipes, boiler makers, ironmasters, &c. The subscribers (each with one share) are:—W. Simons, Penylan Court, Cardiff, iron and steel works manager; and A. Dyson, 32, Rotton Park Road, Edgbaston, engineer. The first directors are:—W. R. Lysaght and W. Simons (appointed by Guest, Keen, Nettlefolds, Ltd., and called the "G.K. and N. Directors"), and T. P. Barker and A. Dyson (appointed by Thomas Piggott & Co., Ltd., called the "Piggott Directors"). The above companies may only appoint directors so long as the directors of such companies or their nominees hold 2,000 ordinary shares. Qualification, £15. Solicitors: Pinsent & Co., 8, Bennetts Hill, Birmingham.

Official Returns of Electrical Companies.

Hawk Radio Devices, Ltd.—Debenture dated April 4th, 1925, to secure £400 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: G. G. Cotton, 110, High Street, Whitechapel, E.

R. & T. Patents, Ltd.—Particulars filed of £650 debentures authorised March 26th, 1925, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Luminor Signs (British), Ltd.—J. Barlow, of 120, Lavenham Road, S.W.18, ceased to act as receiver or manager on April 20th, 1925.

Flather & Co., Ltd. (74,602).—Return dated November 11th, 1924. Capital, £20,000 in £1 shares. 11,044 shares taken up. £9,544 paid. £1,500 considered as paid. Mortgages and charges, nil.

Ledion, Ltd.—W. C. Todd, F.C., of 3, Cannon Street, E.C.4, was appointed receiver on April 22nd under powers contained in debentures dated April 2nd, 1925.

Costa Rica Electric Light & Traction Co., Ltd. (56,447).—Return dated April 15th, 1925. Capital, £130,000 in £1 shares. All shares taken up. £7 paid. £129,993 considered as paid. Mortgages and charges, £283,750.

Newcastle and District Electric Lighting Co., Ltd. (28,022C).—Return dated April 3rd, 1925. Capital, £300,000 in £1 shares. All shares taken up. £300,000 paid. Mortgages and charges, £322,260.

Daysohms, Ltd.—Satisfaction in full on January 15th, 1925, of debenture dated September 5th, 1924, securing £2,000.

R. E. Stichling, Ltd.—Debenture dated April 9th, 1925, to secure £1,000 charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Eltax Elektro Aktiengesellschaft, Charlottenstrasse 96, Berlin, Germany.

Pirelli, Ltd. (103,068).—Return dated October 16th, 1924. Capital, £250,000 in £1 shares. 200,000 ordinary shares taken up. £200,000 paid. Mortgages and charges, nil.

City Notes.

Urban Electric Supply Co., Ltd.

Mr. P. D. Tuckett presided over the annual meeting held on April 30th, and in moving the adoption of the report (*vide* our last issue, p. 708) said that the profit of £125,449 showed an increase of £3,947 over the corresponding figure for the previous year, despite an average increase of 4s. per ton in the price of coal. Apart from Stamford and Glossop, where the adverse effects of trade depression had been specially felt, their undertakings generally had made steady progress, increasing their connections by 1,850 kW, and their output by over 7,000,000 kWh, of which Cornwall accounted for rather more than 6,000,000 kWh. The sum of £50,090 had been written off the reserve for depreciation in respect of plant dismantled during the year; a year ago £27,000 was similarly written off. They were likely to be faced with those heavy charges during the next few years in the process of bringing the plant up to date after 20 years' service and as the result of shutting down the generating stations of those undertakings which were in a position to take a bulk supply from an outside source. Proceeding to deal with what he described as a recent most unexpected and disquieting development, of great moment to the future of the business, Mr. Tuckett said that from 1917 to 1920, in spite of repeated appeals, they remained practically unrelieved of their uncommercial obligation to sell at pre-war rates a commodity which had trebled in cost, until in the early part of the latter year they were all but bankrupt, having been deprived of some £150,000 in the process. With few exceptions their appeals for relief had been consistently opposed by the local authorities, and it was not until their profits and credit had disappeared and the development of the business had practically been brought to a standstill, that a more reasonable and enlightened attitude was adopted at the instance of the newly appointed Electricity Commissioners, five years ago. Since then, they had succeeded in re-establishing their credit and obtaining a moderate measure of prosperity, and it was in the belief that their right to earn a reasonable return on their capital was recognised, that they had been encouraged to embark on the developments which had involved the extensive dismantling of old plant and the consequent heavy charges. Within the last few weeks, however, on the application of the Stamford Corporation, and after a public inquiry, the Ministry of Transport had made an order reducing their maximum rate by 2d. per kWh as from April 1st this year, subject to a minimum charge of 10s. in each of the summer and 15s. in each of the winter quarters. That Order remained in force for the next three years, and according to their calculations, it would have the effect of preventing their Stamford undertaking from making any contribution to their ordinary dividend during the current year, whilst its contribution towards the preference dividend would be considerably less than its proper proportion. The decision appeared to have been inspired by someone imbued with the extraordinary but prevalent idea that if a public utility company could be prevented from earning a profit the consumers would thereby benefit. Whatever inspired it, however, they refused to believe that the decision reflected the considered judgment of the Electricity Commissioners, for, whilst properly anxious to safeguard the rights of the public, they must realise that they did so very ineffectually by condemning them to conduct the business without profit, thereby depriving them of the means of developing it in the interests of the public. Small generating stations, with their very limited field for expansion, had been adversely affected by post-war conditions to a far greater extent than the larger undertakings, yet the general public, including many electrical engineers, utterly failed to appreciate the difference between the conditions governing the supply in large towns and in towns which the company served. They were fully alive to the advantages of trading at the lowest price consistent with an adequate return on capital, and wherever it had been possible, they had during the past two years voluntarily and gladly reduced their prices, but they felt that it would ill-serve the real interests of their consumers if they were to involve themselves in fresh embarrassments by premature reductions which circumstances did not warrant. In most of their smaller undertakings working costs were still nearly double the pre-war level with the maximum rates only 50 per cent. higher. In most of the small towns which they supplied, 1s. per kWh was not under existing conditions a disproportionately high price, nor at that price was electric lighting under modern conditions extravagantly expensive. He regretted to say that the action of the Stamford Council had already encouraged another local authority to apply for a revision of their rate, and there was no disguising the serious menace which it would present if the same treatment were to be meted out to their other undertakings.—Mr. F. E. Gripper seconded the motion, which was agreed to.

Brush Electrical Engineering Co., Ltd.

The profit and loss account for 1924 shows that, after providing for general charges, maintenance of plant and buildings, debenture interest, &c., there remains a balance of £86,457, making, with the sum of £74,919 brought forward, a total of £161,376, subject to corporation profits tax. It is proposed to allocate this as follows:—To depreciation, £15,000; to further 4 per cent. interest on the prior lien participating second debenture stock, £2,044; to income tax, £21,048; to a dividend of 10 per cent. on the ordinary shares, £45,856; leaving £77,427 to be carried forward. The general reserve account has been increased by £1,173, profit on purchase of debenture stocks. The sum of £5,597 was expended on capital account during the year. The report states that the continuance of the general trade depression and the keen competition of home and foreign manufacturers was felt throughout the year, both in the foreign and home markets. These conditions especially applied to the sections of the works devoted to the production of electrical power plant, resulting in a decreased volume of orders being accepted and at unduly low prices. The rolling stock and transformer departments were well occupied throughout the year, and the demand continues to be satisfactory. The meeting is to be held on May 11th.

Madras Electric Tramways (1904), Ltd.

The gross profit for 1924 was £35,434. After meeting interest and London office expenses, transferring £10,000 to the depreciation and renewal account, and adding £7,239 brought forward, there is available a balance of £24,124. The preference dividend and the interim ordinary dividend absorbed £9,000, and it is proposed to pay a final dividend at the rate of 8 per cent., free of tax, on the ordinary shares (making 8 per cent., free of tax, for the year), to write £5,000 off the cost of the 5½ per cent. debenture issue, and to carry forward £7,124. In consequence of the trade depression in Madras and motor vehicle competition, the traffic receipts declined and the expenses were higher. An agreement has been arrived at with the Madras Corporation for the construction of about 10 miles of extensions, and it is also proposed to introduce motor omnibuses to run in conjunction with the tramways. The issue of £130,000 of 5½ per cent. debentures was fully subscribed during the year. The report records the death of the chairman, Mr. A. M. Quill, which occurred on April 21st. Col. G. R. C. Westropp, C.B., has been elected to the vacant seat on the board. Meeting: May 12th.

City of Santos Improvements Co., Ltd.

Presiding at the annual meeting on April 22nd, the chairman (Mr. N. B. Dickson, M.Inst.C.E.) said that the results for 1924 were substantially better than those of the preceding year. The directors had declared a total ordinary dividend of 6 per cent., free of tax, as compared with 3½ per cent., less tax, in 1923. The gas and water undertakings showed progress. The electric tramways had carried an increased traffic, and the track had been extended by 1.3 miles. By arrangement with the Municipality, further extensions were being made during the next two years. Additional rolling stock had been introduced, but still more was required to cope with the traffic at "rush hours." Upon July 1st last the fares were revised, with the sanction of the Municipality; this alteration would enable the company to meet the demand for extended facilities and render possible a more frequent service. The electricity supply undertaking continued to develop satisfactorily, and to meet the constantly-increasing demand the company had carried out considerable extensions to transmission lines and services.

In conclusion, the chairman said that unless a very much lower average rate of exchange was experienced, the results for the current year would be equally favourable.

Rangoon Electric Tramway and Supply Co., Ltd.

The accounts of this company for 1924 show a net profit of £53 602, to which is added £16,497 brought forward, making £70,099. The allocation of this amount was detailed in our last issue (p. 709). The report states that during the year the original electricity supply licences were replaced by a new licence in respect of the extended area, and at the same time a new tramway Order was granted to the company authorising the Kyaikasan tramway extension. Although the car-mileage fell from 2,361,144 to 2,269,569 miles, the number of passengers carried increased from 33,912,042 to 34,913,234. In addition to extensions to the tramways, the company also extended the mains of the electricity supply system. The capital expenditure during the year amounted to £175,454. The annual meeting was to be held in Rangoon on May 1st.

French Companies.

The *Appareils Electriques et Compteurs Garnier*, of Lyons, reports net profits of 390,000 fr. for 1924, as compared with 330,000 fr. in the previous year. The rate of distribution proposed is 65 fr. per share, as against 50 fr. in 1923.

The *Société Industrielle de Produits Electrochimiques Bozel-Lamotte* reports net profits of 6,250,000 fr. for 1924, as compared with 3,679,000 fr. in the previous year, the balance available, with the sum brought forward, being 7,308,000 fr. It is proposed to pay a dividend at the rate of 22.50 fr. per share, as against 20 fr. in 1923.

The *Compagnie Télégraphique des Antilles* reports that the working of the network was effected in 1924 according to the lease entered into in 1908 with the Compagnie Française des Câbles Télégraphiques. It had been impossible to transfer the former's network to the All-America Cables, Inc., as had been proposed, as the consent of the French Government had not been obtained to the carrying out of the scheme.

The *Société de Construction Electrique*, of Lyons, has declared a dividend at the rate of 7 fr. per share for 1924 out of net profits of 405,000 fr.

The directors of the *Compagnie Française Thomson-Houston* report net profits of 14,940,000 fr. for 1924. It is proposed to apply this to depreciation and to the reserve funds.

The directors of the *Société d'Electro-Chimie, d'Electro-Metallurgie et des Acieries Electriques d'Ugine*, recommend a dividend of 8 per cent. for 1924.

German Companies.

The *Electricity Supply Company*, of Berlin, reports an increase in the consumption of electrical energy in 1924, and states that four subsidiary undertakings were able to pay dividends of 8 per cent. and a fifth a dividend of 5 per cent. It is intended to distribute 8 per cent. out of net profits of 1,750,000 marks.

The report of the *Elevated and Underground Electric Railway Company*, of Berlin, states that the chief attention of the directors was devoted last year to overtaking the arrears of maintenance and renewals. A number of new coaches were ordered and many were delivered. The wages rose by 45 per cent.; this, however, is now being counteracted by the increase in fares which came into force in March, 1925.

Swiss Companies.

The *Financial Company for Electrical Undertakings in the United States*, of Geneva, reports net profits of 1,280,000 fr. for 1924 and a dividend at the rate of 9 per cent. as the previous year.

The accounts of the *Accumulatoren Fabrik Oerlikon*, after providing for depreciation, show net profits of 623,000 fr. for 1924, as compared with 610,000 fr. in the previous year. The rate of distribution, as in preceding years, is 20 cent. on the share capital of 2,200,000 fr.

Companies Struck Off the Register.—The names of the following companies have been struck off the Register, and they are thereby dissolved:—

Electric Transport Co., Ltd.
Ennis Electric Light & Power Co., Ltd.
Maxim Electrical Co., Ltd.
Portable Searchlight & Signalling Co., Ltd.
Woodrow General, Mechanical & Electrical Heating Engineering Co., Ltd.

Melbourne Electric Supply Co., Ltd.—The debenture holders are to be asked at a meeting on May 27th to confirm an agreement for the sale of the company's undertaking to the Victorian Government. This agreement provides that the year of purchase shall be 1930 at the option of either party, in 1933 at the option of the State only, or 1935 at the latest.

The purchase of the debentures will be effected by their exchange for Government debentures of an equivalent amount bearing the same rate of interest. This exchange can be effected at once by debenture holders who so desire. During the period prior to purchase, arrangements have been made for the maintenance of a minimum rate of dividend of 7 per cent. on the ordinary shares.

Stock Exchange Notices.—Application has been made to the Committee to allow the following to be officially quoted:—

Barcelona Traction, Light and Power Co.—274,500 common shares of $50 each, fully paid, and £2,147,500 five and a-half per cent. first mortgage bonds.

The undermentioned have been ordered to be officially quoted:—

American Telephone and Telegraph Co.—$3,054,800 capital stock.
Brompton and Kensington Electricity Supply Co.—90 ordinary shares of £1 each, fully paid, Nos. 291,826 to 291,916.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

American Telephone and Telegraph Co.—$3,054,800 capital stock in shares of $100 each.
Brompton and Kensington Electricity Supply.—90 ordinary shares of £1 each, fully paid, Nos. 291,826 to 291,915.
Madras Electric Supply.—250,000 new five and a-half per cent. (free of income-tax) cumulative preference shares of £1 each, issued at 21s. per share, partly and fully paid, Nos. 50,201 to 303,200.
Burndept Wireless.—600,000 deferred shares of 1s. each, fully paid, Nos. 1 to 600,000.
East African Power and Lighting.—£100,000 sterling seven per cent. registered notes, Nos. — to 1,000 (£100).

Mid-Cheshire Electricity Supply Co., Ltd.—The report of this company (formerly the Northwich Electric Supply Co., Ltd.) for the past year shows a net profit, after providing for depreciation, of £7,588. After transferring £4,000 to reserve, a dividend of 8 per cent. is to be paid on the ordinary shares, and £685 as a bonus to the staff. The North Wales transmission line, which is to be tapped for a bulk supply at two points—Hartford and Winsford—is approaching completion, and it is hoped that the bulk supply will be in use before the end of the current year.

Dutch Company.—The *N.V. Hollandsche Draad en Kabelfabriek*, of Amsterdam, reports gross profits of 163,000 florins for 1924. After defraying general expenses, the balance has been applied to depreciation. The directors complain of foreign competitors who offer cheap products in the Dutch home market, whereas Dutch exports to Germany are impossible owing to the existence of an import veto on wires and cables.

English Electric Co., Ltd.—The report for 1924 shows that the net profit was £263,781, as compared with £261,793 in the preceding year. A sum of £69,713 is brought forward, making available £333,494. After making provision for debenture interest, preference dividends, &c., and paying a dividend of 5 per cent., less tax, on the ordinary shares (as in 1923), a balance of £73,917 is carried forward.

Midland Counties Electric Supply Co., Ltd.—An extraordinary meeting is to be held on May 11th for the purpose of approving the increasing of the company's capital from £2,000,000 to £3,000,000.

Reduction of Capital.—TUNGSTEN MANUFACTURING CO., LTD., AND REDUCED.—A petition for the confirmation of the reduction of the capital of the company from £150,000 to £142,400 has been presented to the High Court, and will be heard in London on May 15th. (See our advertisement pages to-day.)

City of Buenos Ayres Tramway Co. (1904), Ltd.—A dividend at the rate of 5 per cent. (1s. 3d. per share) has been declared for the quarter ended March 31st last.

Mississippi River Power Co.—The gross earnings during 1924 amounted to $3,191,911, and the net revenue to $2,367,473. A surplus of $1,980,409 is carried forward.

Stocks and Shares.

MONDAY EVENING.

UPON first considerations, the Stock Exchange pronounced the Budget to be a good one, but the favourable effect produced upon prices by the Chancellor's speech proved transitory. As the dust subsided, it became obvious that the chief consideration, from the purely Stock Exchange point of view, is the re-establishment of the gold standard, with its concomitant effects of a rise in money rates and a corresponding dulness in gilt-edged securities. This has given pause, of course, to investment. The people who had been holding back money that they intended to spend in Stock Exchange markets, after the Budget speech had revealed the Government's intentions, are still in hesitating mood, owing to the facts that money has stiffened, that the War Loan and other British Government funds have drooped, and that there is a prospect of further

dulness developing in a manner that will provide still cheaper stock.

The whole of the Stock Exchange markets are influenced in a greater or less degree by this gold standard factor, as many people declare it to be, and while it has no direct bearing upon such shares as those, for instance, in the electricity supply list, the hardening of money rates plays its part in the industrial market, in the same way as it does with fixed-interest stocks.

The prices of home electricity supply shares are remarkably steady, with Westminsters 6d. better at 44s. 6d. and Charing Cross ordinary up to 45s. 9d. Small falls occurred in County ordinary, Edmundsons and Urbans. The County of London has issued invitations to some of its friends in respect of the opening of the new Barking station by the King on Tuesday week, May 19th, when His Majesty will be accompanied by the Queen. This is a proud occasion for the County of London shareholders, and still more for the chairman, Sir Harry Renwick, K.B.E., who has spent his business life in bringing to its prosperous present state the company over which he so ably presides.

The Chagford & Devon Electric Light Company continues to offer for sale certain extension capital in shape of ordinary and preference shares and 7½ per cent. first mortgage debentures. The offer for sale is made by the company. The chairman is Lieut.-Col. Eaton, C.E., and the other directors are Sir Charles Soame, Bart., and Mr. R. G. Harley. The absence of much of the ordinary information for which investors in electricity supply companies are entitled to ask before they put money into shares or debentures of such undertakings constitutes a sufficient reason for leaving the issues to the people who know most about them.

The recent issue of Madras Electric Tramways 5½ per cent. tax-free preference shares was not entirely subscribed, though underwriters were relieved of their responsibility and received commission on the proportion of shares which were taken by the public. These preferences are now on offer at 20s. 9d., which is 3d. per share less than the issue price, and they make a good industrial investment of their class. The company has just declared a dividend of 8 per cent. free of tax, making 8 per cent. for the year, which is the same rate as that of last year, when, however, 2½ per cent. bonus was also distributed. The gross profit of £35,400 goes against £37,600 in the year before. The Rangoon Electric Trams reports a gross profit of £154,000, which is substantially better than the figures for 1923. The dividend, however, is maintained at the same rate as that of the previous twelvemonth.

The Melbourne Electric Supply Company has called a meeting of its debenture-holders to take place on May 27th, to confirm an agreement for the sale of the undertaking to the State of Victoria. The agreement provides that the year for purchase shall be 1930 at the option of either the State or the company; 1933 at the option of the State only, or 1935 at the latest. The price of the ordinary stock is 145, the 8 per cent. first preference stand at 5½, and the company's 5 per cent. first mortgage debenture stock is quoted at 98 middle.

Amongst cable stocks and shares, Great Northerns are 5s. up at 32½ and Indo-Europeans retain their £2 rise at 39½. Oriental Telephones dropped to 2 1/16. Cuba Submarines are unchanged at 7½. In the recent report it is stated that the directors have devoted all available income to strengthening the reserves after payment of the 5 per cent. dividend. Siemens gained 2s. on the announcement that the company had received an important contract in connection with the construction of the new Pacific cable. The Telegraph Construction Company has undertaken the rather larger part of the same work, but the price of its shares has not changed.

Home Railway stocks are weak, and the market seems to have no friends at all. Underground ordinary are the only shares in the list to show any resistance to the general tendency, the price in their case having recovered the half-a-crown loss which it sustained last week. Metropolitans weakened to 76, although, on the other hand, the Surplus Lands rallied to 72. The London traction issues are steady.

Anglo-Argentine Tramways 5 per cent. debenture gained two points at 75. Apart from this, the foreign traction list is unchanged. There is nothing doing in Brazilian Tractions. The Mexican group is inclined to give way. Mexican Electric Light 5 per cent. bonds at 63½ show a small decline.

Edisons strengthened to 8s., which makes the return on the money 5 per cent. at the present price. India Rubber shares are better at 20s. 6d., though, on the other hand, Cromptons eased off to 12s. 6d. English Electrics at 17s. 9d. have shed 6d. British Thomson-Houston 7 per cent. debenture is lower at 108¼. Babcocks are a good spot at 2¼, showing a rise of nearly a florin. Automatic Telephones further advanced to 42s. 6d., being 7s. 6d. up in a fortnight. International Telephones, however, linger at 25s. 3d.

Marconis are unchanged at 32s. 6d. Canadian Marconis at 4s. 10½d. are a little easier. International Telephone stock, mentioned here last week as recently introduced stands at 9¼. Johnson & Phillips are better than the nominal price indicates, thanks to the satisfaction felt with the 10 per cent. dividend and the company's excellent report. No improvement has occurred in rubber shares, in spite of the raw produce having strengthened to 1s. 10d. per lb. The iron and steel market parted with the improvements that were gained upon the hopes aroused by advance anticipations of the Budget. Nothing is to be done for the protection of the "heavy" industries, and the shares fell back in consequence.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Dividend. 1923.	Dividend. 1924.	Price May 4 1925.	Rise or fall.	Yield, p.c.
Bournemouth and Poole ...	1	13	14	21¾	—	4 19 7
Brompton Ordinary	1	10	10	12	—	*5 14 3
Charing Cross Ordinary	1	14½	15	45/9	+9d.	6 11 2
do. do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	12	38/9	—	6 4 0
City of London	1	15	15	2⅞	—	6 9 10
do. do. 6% Pref. ...	1	6	6	23/6	—	5 2 2
Clyde Valley	1	8	8	32/6	—	4 18 6
County of London	1	15	15	53/9	— ⅛	5 11 6
do. do. 6% Pref. ...	1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	1	7	—	24/-	—6d.	5 16 8
do. 7% Pref.	1	6	—	23/-	—	6 1 9
Elec. Supply Corporation ...		10	10	31/3	—	6 8 0
Kensington Ordinary	5	14	15	12⅝	—	5 18 10
Lancs. Light and Power ...	1	7½	7½	28/-	—	5 7 —
London Electric	1	10	10	36/6	—	5 12 6
do. do. 6% Pref. ...	5	6	6	5⅛	—	5 7 7
Metropolitan	1	10	11	38/3	—	5 15 6
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	24/3	—	4 19 0
Newcastle-on-Tyne Ordinary ...	1	6	7	23/9	—	5 17 11
do. 5% Pref. ...	1	5	5	18/9	—	5 6 8
do. 7% Pref. ...	1	7	7	25/6	—	5 9 10
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref. ...	1	6	6	1¼	—	5 6 8
St. James' and Pall Mall ...	5	17½	17½	13½	—	6 9 8
South London	1	15	15	2½	—	6 0 0
South Metropolitan Pref. ...		7	7	1½	—	5 13 0
Urban Ordinary	1	4	4	1	— ⅛	4 0 0
do. 6% Pref. ...	1	6	6	20/6	—	5 17 1
Westminster Ordinary	1	15	15	44/6	+6d.	6 14 10
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	19/9	+3d.	7 12 0
Yorkshire Elec.	1	8	8	30/6	—	5 5 0

Home Rails.

Central London Ord. Assented Stock	4	4	69	—	5 15 11
Metropolitan ... ... ,,	4	5	76	—1	6 11 7
do. District ... ... ,,	8½	8½	48½	—	7 4 4
Underground Electric Ordinary	10	Nil	Nil	2⅞	+ ⅛ Nil
do. do. "A" ...	1/-	Nil	Nil	8/-	— Nil
do. do. Income	Bonds	6	6	97	—	*6 3 9

Telegraphs and Telephones.

		Dividend. 1922.	Dividend. 1923.			
Anglo-Am. Tel. Pref.	Stock	6	6	104½	—	5 14 10
do. Def.	,,	1½	1½	24	—	6 5 0
Automatic Telephone	1	Nil	8	2½	+ ⅛	2 16 6
Chili Telephone	5	6	6	5⅞	—	*5 10 4
Cuba Sub. Ord.	10	7	5	7½	—	6 18 0
Eastern Extension	10	10	10	17½	—	*5 14 3
Eastern Tel. Ord.	Stock	10	10	177½	—	*5 12 8
Globe Tel. and T. Ord.	10	10	10	18	—	*5 11 1
do. do. Pref.	10	6	6	11½	—	5 7 10
Great Northern Tel.	10	24	22	32½	+ ½	6 16 6
Indo-European	25	7	7	39½	—	*5 7 7
Marconi	1	15	10	1⅝	—	6 3 1
Marconi Marine	1	10	10	1⅝	—	6 17 10
Oriental Telephone Ord. ...	1	12	12	2⅛	— ⅛	*5 16 3
United R. Plate Tel.	5	8	8	7⅛	—	*5 13 3
Western Telegraph	10	10	10	17½	—	*5 15 11

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	12½	5½	8½	—	8 9 3
do. do. 2nd Pref. ...	5	5½	6	9¾	—	10 7 10
do. do. 5% Deb. ...	Stock	5	5	75	+2	6 13 4
British Electric Traction Ord. ...	,,	5	6	107½	—	5 11 7
do. do. 6% Pref. ...	,,	6	6	107½	—	5 11 7
Brazil Traction	100	4	4	53½	—	7 9 7
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	89½	—	5 11 9
do. do. Preferred	,,	6	96/-	89½	—	*5 7 3
do. do. Deferred	,,	8	129/6	107½	—	*6 0 6
do. do. Deb.	,,	4½	4½	78½	—	5 8 3
Lond. & Sub. Trac. 5% Pref. ...	1	5	2½	6/6	—	Nil
London United Tram. Deb. ...	Stock	4	4	47½	—	8 8 5
Mexico Trams, 5% Bonds ...	—	Nil	5	66	—	7 11 6
Mexican Light Common ...	100	Nil	Nil	26	—	Nil
do. Pref.	100	Nil	Nil	61	—	Nil
do. 1st Bonds ...	—	5	5	66½	—	7 10 5
Yorkshire (West Riding) ...	1	—	5	1	—	5 0 0

Manufacturing Companies.

Babcock & Wilcox	1	20	12	2¼	+ ⅛	4 7 4
British Aluminium Ord.	1	5	5	8/-	—	3 2 6
British Elec. Transformer Pref.	1	Nil	Nil	17/6	—	... ...
British Insulated Ord.	1	15	15	3⅛	—	4 17 11
Brush Ord.	1	10	10	25/9	—	5 4 3
Callenders	1	15	15	3⅜	—	4 9 0
do. 6½% Pref. ...	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	5	Nil	⅝	— ⅛	... ...
Edison-Swan	4/-	7½	10	8/-	+ 3d.	5 0 0
do. 5% Deb.	Stock	5	5	83	—	6 0 6
Electric Construction	1	10	10	33/9	—	5 19 10
Enfield Cable, Pref.	1	7½	7½	1½	—	6 0 0
English Electric	1	8	5	17/9	—6d.	5 12 7
do. do. Pref.	1	6	6	21/-	—	5 14 3
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 1
do. Ord.	1	5	5	23/-	—	4 16 11
Henley	1	15	15	3⅜	—	4 14 1
do. 4½% Pref.	5	4½	4½	4½	—	5 0 0
India-Rubber	1	10	5	20/6	+6d.	*4 17 7
Johnson & Phillips	1	5	10	1⅜	—	5 9 1
Met-Vickers, Ord....	1	12½	8	23/9	—	5 14 9
do. Pref.... ...	2	8	8	2⅜	—	6 14 9
Siemens Ord.	1	5	—	27/-	+2/-	3 14 0
Telegraph Construction... ...	12	20	20	27	—	*4 14 1

* Dividends paid free of Income Tax.

National Electric Power.—III.*

By R. C. ANDERSEN.

Proposals.

In each of the principal industrial districts of Britain there are to be found one or more large power companies. These organisations, created to meet local needs for large blocks of power, logically offer themselves as the starting points from which should radiate any new economic networks. Were such a development inaugurated it would have the advantage of being pushed forward by companies which possess intimate knowledge of their regional markets, together with specialist staffs which could adequately deal with rapid extension within the bounds of economy. Efficient interconnection between adjacent interests must be established, and here a pooling of operating experience would lead to the adoption of a comprehensive standardisation throughout the country. In this way British electrical development, while conforming to existing economic circumstances, would follow rational and orthodox lines.

The value of the power company as an instrument for rectifying the backwardness of British electricity supply lies in its being the only organisation extant which operates over a large area through the medium of private enterprise. I stress private enterprise in this instance for two reasons. First, because it is acknowledged that this type of initiative is successful. Secondly, because the system arranges for its finance direct with the investing public, and in the event of any loss being incurred, it bears this without seeking any amelioration from Government sources. This is seen to constitute a tremendous advantage to the nation as compared with any system such as that of an accredited Joint Electricity Authority—the only other body possessing powers to operate over a large area—which recoups its losses direct from the citizen, viewed as a ratepayer.

It has been stated in an earlier section of this article that the generation, transmission, and distribution of electricity respectively comprise different facets of a single business. On this basis the very first thing to be done if power companies are to solve our problem is to invest them with powers enabling them to supply electricity for all purposes in their areas. It would seem logical to suppose that such a step would lead directly to the clearing away of the subsidiary companies at present operating under the aegis of the parent power concerns. Much duplication and unnecessary administration would thereby be eliminated. Distribution could also progress unfettered by the prospect of surrendering its works at the end of a specific term to local authorities.

To close down the subsidiary companies alluded to is comparatively simple. Only when one contemplates the activities of local authorities generating and supplying their own electrical energy does the problem of economic development assume an intensely complicated form. These authorities have been endowed with their privileges in perpetuity. The net profits they earn often go to the relief of the rates. The local systems laid down by them are manifold and quite unrelated. Here in brief are the main factors presenting an obstacle to the type of development under consideration. It would be ridiculous not to face the municipalities' case squarely. Judged from the municipal point of view, that is to say, the view of the township as a unit, their organisations based on possession are sound. What then? The answer is clear. We are in an electrical age. Cheap and abundant supplies of electricity are vital to the nation if it is to continue to thrive industrially. Could the cheap and abundant supply we are seeking throughout the length and breadth of the land be obtained by the hundreds of local systems functioning at the moment, no controversy would exist. It is obvious to all, however, that our present methods are wasteful and extravagant when compared to the results that would accrue from the creation and working of composite networks at a relatively high voltage. In these circumstances if it can be clearly proved that a municipal plant cannot possibly compete with bulk supplies from a power company, this plant should be shut down.

It now becomes apparent that power companies need something more than the right to supply energy for all purposes. Some mechanism must be evolved which will envisage the compulsory shutting-down of uneconomic stations. Having regard to the capital tied up in plant, works, &c., closure can only be applied by out-and-out purchase or through the natural obsolescence of the plant. In most cases out-and-out purchase is unlikely because existing revenue would not justify large capital expenditure by the power company interested. Due to the rapid expansion normal to the industry, it is just as unlikely that complete obsolescence of the present plant will occur. A middle course such as the following is therefore anticipated. An ever-increasing load will absorb the latent capacities of the existing generating stations until the stage will be reached when new plant is indicated. At this point legislation should be such that power companies are automatically approached and asked to table propositions for future supply, including, if necessary, the laying down of new distribution mains.

Now it is obvious that in negotiations such as are here indicated an arbitrator will be needed, for it is inconceivable that a municipality anxious to retain its electricity supply powers (not to mention its prestige) will blithely accept what its rivals may have to offer. "Economic production and supply of electricity is the national aim," they may argue. "Very well then. Here is an alternative to the power company's scheme which, while it produces the same results, still enables us to retain our privileges." This would be a just claim, and, provided the municipality's proposal takes note of certain stipulated standardisation, there would seem to be no reason why it should not be carried out. Only an arbitrator conversant with the full detail of national development, however, could pass final judgment as between two such sets of proposals, and this would have to be based primarily and solely on the national welfare. I can conceive of no one better suited to carry out the duties of such an arbitrator than the Electricity Commissioners, who occupy a unique position as representatives and guardians of the general public. Their judgment should be final and binding, and they should exercise compulsory powers to enforce their decrees if necessary. Were such a plan followed, municipalities would be given a competitive opening to continue their electricity supply, while at the same time the industry would be placed in a position to reap to the full the benefits of private enterprise. In either circumstance the national need translated into terms of low-priced electricity would be the paramount issue.

Unless due steps are taken to safeguard the interests of the consumer, the supply industry, particularly under the influence of private enterprise, would soon evolve into a monopoly. This would be an impossible situation. The maximum charge per unit should therefore continue to be fixed by the Electricity Commissioners.

The unusually important part finance plays in the industry will be remembered. Everything possible should therefore be done to protect the investor and to ensure that electric power shares become what they logically should be, *i.e.*, gilt-edged securities. To this end the Electricity Commissioners should be empowered not only to fix the maximum percentage returns on capital invested, but also to scrutinise and pass an independent judgment on all prospective power issues. It might even be advisable to stipulate that their views be

*Previous articles appeared in our issues of April 24th and May 1st.

printed as a part of the prospectuses issued by companies in connection with their calls for new money.

National standardisation of electric power works and lines is imperative if true economy is to be attained. The Electricity Commissioners' Regulations already set out design requirements. Standard voltages and frequency should also be determined by them. Based on these, manufacturers should be left unhindered to produce their competitive standards. Such a procedure would tend to eliminate unorthodox material, with resultant savings tending to lower costs in the workshops.

In a scheme such as the one under review efficient interconnection is fundamental, for without it colossal sums of money would be tied up in stand-by plant, and areas of operation would become so many water-tight compartments. With proper interconnection, on the other hand, districts—if only from the point of view of financial expediency—would naturally tend to merge. In this connection I visualise a number of power systems so closely interwoven as to constitute a common reservoir of electrical energy. Generation would be effected by large plants situated in the best localities, and annual blocks of power would be contracted for at cost as between adjacent companies. The swinging to and fro when necessary of these blocks of power would immediately eliminate the need for more than a relatively small amount of stand-by plant, and it is interesting to note that the huge savings thereby effected would be realised simultaneously with added security in the matter of continuous service.

The annual power contracts entered into as between companies must be carefully pre-arranged, for on the maximum power call between two adjacent concerns must depend the ultimate capacities of the interconnecting links.

As an example of what can be done by a policy such as is here indicated, I would refer the reader to the findings of the Transmission Lines Committee of the Empire Gas and Electric Association, set up in New York State in 1923 to study the specific problem of economic power supply as between companies in that territory. The Committee divided itself into four sub-committees to deal respectively with :—

1. Load, distance and voltage.
2. Frequency.
3. Line and sub-station costs.
4. General information.

The net result of their considerations was that, provided proper interconnection was adopted :—

(*a*) 60,000 kW of stand-by plant could be released in 1923. This represented a release of $7,875,000 in capital invested.

(*b*) A saving in installed capacity of 237,000 kW could be effected by 1933. This would represent a plant investment of $37,125,000.

(*c*) $1,750,000 more could be earned by existing plant in 1923.

(*d*) A saving in coal of 137,500 tons could be made, which, at a normal price of $6, works out at $825,000 saved in coal bills.

Summation.

1. Clear indications exist that the nation is not satisfied with the present position of electricity supply in the country.

2. Analysis as to the reasons of the relative backwardness of Britain in this particular industry demonstrates that it is principally due to the vested interests arising out of past legislation.

3. The obstacles to progress are natural results which one would expect under existing conditions. Why, one may readily ask, should local authorities render up the rights conferred upon them, particularly as in the majority of cases they supply electricity as cheaply as it can possibly be supplied in the circumstances surrounding their areas? The plea put forward is that, though judged from the local point of view their attitude is not only admissible but absolutely right, nevertheless the time has come when national destiny demands a ruthless absorption of small supply areas into large ones electrified by means of a relatively few generating stations erected at strategic centres. In no other way can true economy with its resultant bearing on industry and general trade alike be realised.

4. Rather than supervision of the large areas necessary for proper development by Joint Electricity Authorities, it is submitted that they should be placed in the hands of power companies with extended rights. By this means the nation will not only obtain a cheap and abundant supply of electricity, but it will be free of all matters pertaining to new finance and possible losses. Development under these conditions will also tend to be completed more rapidly.

5. Electricity supply must on no account become an unregulated monopoly, for it is too vital a factor in the life of the nation. The State, through the Electricity Commissioners, should therefore control electricity charges and standardisation of voltage and frequency. In order that all new works requiring new capital may receive the sanction of the Commissioners, company prospectuses relating to the creation of new shares should have incorporated in them the unbiased judgment of the Electricity Commissioners on the proposed works. The public will thus be put in possession of all the facts prior to investing its money. In the event of the Commissioners refusing to hall-mark the new issues as sound, it is unlikely that they will succeed.

6. Interconnection between power companies is essential, and must, therefore, be established in return for enhanced powers. Proper interconnection will not only prove a safeguard against the tying up of abnormal capital sums in stand-by plant, but it will also give rise to vast savings and will ensure continuous service.

Conclusion.

Britain has not yet fully emerged from the steam age which saw her rise to greatness, whereas her chief rivals in trade have progressed electrically by leaps and bounds. The delay in development, however, has not been altogether an evil for it has enabled us to watch what other countries have been doing, and to profit by their mistakes. The time has come, however, when if we are to realise our destiny as a great and powerful industrial nation, we must make a desperate effort to catch up lost ground and put our industrial house in order. This we can do only by sinking local interests in favour of those of the nation, and it is in our proved capacity to take the long and big view that I pin my faith. The times are out of joint, and we have suffered more than our fair share of industrial misery consequent on the war. This question of economic electricity supply coming at an abnormally distressing period has made its solution infinitely more difficult. Nevertheless, with our natural coal resources, the directing influence of our Electricity Commissioners, and our native doggedness in completing a job thoroughly when we once begin, I rest assured that we will witness a highly efficient electrification of our country in the near future.

American Automatic Generating Stations. — The largest automatic electricity generating station in America has been contracted for with the United States General Electric Co. It will be located at the Soft Maple development of the Northern New York Utilities Co., near Watertown, N.Y., and will have installed two 10,500-h.p. sets, its size being the significant thing about it, for until the last few years most automatic stations did not much exceed 1,000 h.p. in capacity. The Soft Maple station is to be controlled from the Taylorville generating station, 15 miles distant, from which it will be started and stopped by energising and de-energising the transmission line. Power from the station will be transmitted at 66,000 volts. The trend in automatic station development is clearly shown by another order for a comparatively large station of this type, also being built by the General Electric Co., for the St. Lawrence Valley Power Corporation at Potsdam, N.Y. This will be a 6,400-h.p. plant, consisting of two 3,200-h.p. sets, and the energy which it generates will be transmitted at 88,000 volts. Both these stations will be hydro-electric. The largest type of automatic hydro-electric station at present operating is represented by the 6,500-h.p. Searsburg station on the Deerfield river in Vermont, part of the New England Power Co.'s system. It was one of the first sets of plant to prove conclusively that the automatic station was as practicable with large generators as it was with small ones.

Capital Charges in Municipal Electricity Undertakings.

By "INTERESTED."

AWAY back in the year 1910 there were published in the columns of the ELECTRICAL REVIEW certain facts and possibilities regarding the future financial position of municipal electricity supply undertakings. Those remarks were appropriate at that time, and reflected upon the future. That "future" is present to-day, and the suggested possible conditions mentioned years ago are now causing serious concern.

Because very little has been heard lately regarding the financial aspect of these stations, it must not be assumed that there does not exist anything which calls for serious contemplation.

One of the signs visible to all who widely observe is the frequent mention of these, and other pertinent matters, by local accountants, either directly or through their associations. The knowledge that these officials are gradually but surely reaching out far in their endeavour to control yet further the financial management of these undertakings should advertise the fundamental fact that the present managements are in a somewhat precarious frame of mind as to the best method to adopt in future for securing a reasonable annual capital expenditure.

The chief trouble existing, no doubt, is regarding the best method of procedure. Supply stations must extend in order to meet continually increasing demands for electricity, and a lack of sufficient capital is the sure way of making those conditions impossible. All are thoroughly conversant with the peculiarities of that period of the great war, followed immediately afterwards by demands for more plant, which necessitated mortgages at an inflated rate of interest. Now that the money market is easier, prices charged for current have dropped so far that the Plimsoll mark is in danger of becoming obscured.

The great stumbling block against further reduction in prices charged for energy is the high rate of interest demanded on loans during recent years, which will remain as a source of danger for many years to come. The average capital charge per unit sold in Metropolitan municipal electricity works for the year 1923-24 approximated .75d. These are facts within the knowledge of all concerned, and the only safeguard which might mitigate the present peculiar circumstances is the presence of an ample reserve fund.

What is the present practice? In those undertakings where the accountant has set foot, calm suggestion and advice is tendered to the effect that certain profits should be annually set aside for relief of rates, and by thus depleting the reserve the tendency is seriously to diminish the value of practically the only remaining safeguard, and the notorious fact is that in many districts members of local councils seem willing joyously to accept the dictates of their financial officers without paying due importance to the views or advice of their engineers or managers, thereby jeopardising the financial position of their undertakings because of that lack of power of ready perceptibility essential in every candidate for municipal service.

The claims for taking proportionate sums from electricity works funds for relief of rates seems to be based by accountants on the one fact that security for all loans raised by electricity supply stations is upon the rates. But has that security actually cost ratepayers a single penny? In practically every case the answer is emphatically in the negative.

Recently I heard of a certain financial officer who reported that if it were not for the fact that electricity department loans were borrowed solely upon the security of the local rates, and not upon the revenue of the undertaking, the rate of interest would correspondingly be increased from one to one and a half per centum. How delightfully vague! Yet there are some who immediately accept so bald a statement without further consideration. Obviously any undertaking where the practice is to retain all profits, instead of pandering to the whims of a number of vestrymen or councillors by paying rates for the community at large, must have accumulated sufficient reserve to warrant that sum being offered as security for loans up to an appreciable amount. The fact stands out boldly that, where an electricity department regularly feeds the rates, those rates are not doing ordinary, common justice in return by merely standing as ordinary security for future mortgages. Why? Because they have already received payment over and over again for this from the profits of the undertaking.

Some will, perhaps, argue about the guarantee for early loans. Well—that is like an ordinary moneylender refusing to accept repayment of principal yet demanding the interest on it continually, year after year, with no finality. Such acts are ever being decried all over the country. There are some local governing representatives who will accept almost anything in one second, when there appears opportunity to relieve the rates at the expense of their electricity supply undertaking. Someone whispers "Votes." May be so; but any member of a local council should be above such a suggestion. Rather do I think it is altogether the absence of thought which induces such action.

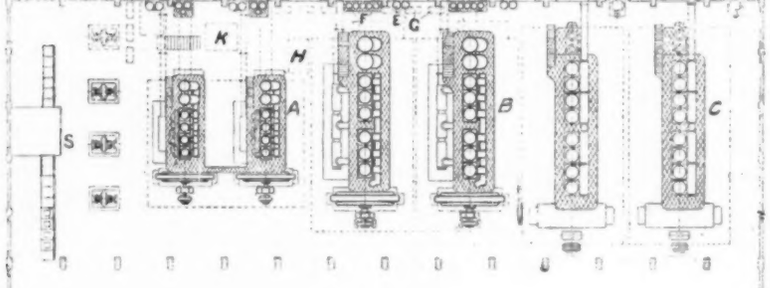
None can deny that any profit-making municipal electricity department which retains profits and steadily builds up a respectable reserve fund is in a far more favourable position regarding the provision of fresh capital for extensions than one which possesses merely a skeleton reserve depleted by the constant strain of relieving the rates. In that same district, too, there is better opportunity for reducing charges for supply, as only those stations having sufficient reserve funds can offer current at such low rates that the possibility of an adverse balance in any one year does not scare away due consideration for fear of that wicked apparition "Rates."

Generally speaking, ratepayers have no just claim to the major portion of their electricity works profits. An occasional penny rate is ample payment for the security afforded, and all other profits should be retained and handled in such manner as to allow current being sold to those ratepayers in the district, who are educated to the use of electricity, at the lowest figure compatible with economical trading.

X-ray Testing in the Foundry.—Some interesting notes are made on the application of X-ray testing to foundry practice, in the April *Bulletin* of the British Cast Iron Research Association. Current methods of testing have the defect that they involve destruction of the material, and hence must be applied to test bars and not to the castings themselves. It is impracticable to apply X-ray testing as a routine method, but it is possible that in planning composition, melting and moulding methods for a new type of casting, especially for mass production work, great use might be made of X-rays in the preliminary stages of the work to ascertain whether the methods adopted are producing sound castings. It is argued that defects of a similar character may occur continuously if the methods adopted are wrong and that the X-ray may afford opportunities of correcting defects and thus avoid trouble before production is commenced. Sample or pilot castings are made and tested in all ways, including X-ray testing, before the methods of production are finally determined. The *Bulletin*, which is issued quarterly and published at the offices of the Association, 75, New Street, Birmingham, contains considerable information concerning the activities and researches of the Association.

A Chinese Diesel-Engined Power Station.

THE Compagnie Francaise de Tramways et d'Eclairage Electriques de Shanghai has for some years maintained the electricity and tramway service in the French quarter of the city of Shanghai by means of a steam-operated generating plant of 1,500 kW capacity. As a result of the increase in population a bigger output became necessary, and on account of various difficulties which had been experienced with the steam plant—among which was that of poor coal—it was decided to erect an entirely new station and to equip it with plant operated by means of internal combustion engines. The new station is one of the most important of the kind in the Far East.



A = Two 1,200-kVA sets. B = Two 3,300-kVA sets. C = Location for two 4,600-kVA sets. E = Fuel tanks. F = Compressor air cylinders for engine starting. G = Electric pumps. H = Piston-cooling water tanks. K = Hotwater tank. M = Water tower. N = Cooling towers. O = Silencers. P = Exhaust pipes. Q = Air inlets. S = Converter sub-station for tramway supply.

Fig. 1.—Plan of Shanghai Diesel-engined Power Station.

The main building is of the single-storey, ferro-concrete type, the area covered being 65½ by 197 ft. The engine house is provided with a 25-ton electrically-operated, overhead travelling crane and in the basement are located the fuel and water circulating pumps, all of which are of the Sulzer centrifugal type.

The full programme provides for the eventual installation of six generating sets of a total of 18,200 kW capacity. The existing plant comprises two Diesel engines constructed by Messrs. Sulzer Gebruder, of Winterthur, Switzerland, coupled direct to Oerlikon, 1,200-kVA flywheel alternators, and a 3,300-kVA Sulzer-Diesel engine with a Schneider alternator; both the Oerlikon and Schneider alternators are designed to generate at 50 cycles and 5,500 volts.

The 1,200-kVA engines have four cylinders and run at 150 r.p.m., while the 3,300-kVA engine has six cylinders and operates at 125 r.p.m. All the prime movers are of the two-stroke type and embody the exhaust scavenging and supplementary air supply principle which is characteristic of Sulzer-Diesel engines. Fig. 1 is a plan of the station and fig. 2 is a view of the two 1,200-kVA sets. It is claimed that the two-cycle system, combined with exhaust scavenging and supplementary air admission at the lower portion of the cylinders, simplifies the design of the combustion chamber and distribution gear. The combustion chambers have only a single central opening in which are mounted combined fuel and starting valves. In this way not only is the casting a simple one, symmetrical in shape and of great strength, but, owing to the provision of wide and regular water cooling spaces, the expansion pressures are rendered uniform. The pistons, which are built up in two parts, embody a cooling system consisting of telescopic tubes; they are connected together in a special manner which shields the joint from the action of hot gases. The engines are provided with automatic governors which control not only the amount of charge, but also the degree of combustion and the duration of the explosion. For starting the engines compressed air cylinders filled by the engine compressors are utilised; for emergency use a small auxiliary air-compressing plant is provided.

Thury automatic voltage regulators are provided in connection with the alternator excitation circuits; the switchboards and distributing apparatus are located in a two-storey building parallel with the engine room.

For the running of the engines fuel oil imported from the Dutch East Indies is utilised, it being stored in six underground cement tanks of a total capacity of nearly a quarter of a million gallons. At the side of the station is located a water tank of 88,000 gallons capacity and two cooling towers, each of a capacity of 44,000 gallons, the latter being necessary owing to the fact that the available water supply is not too plentiful.

At the southern end of the engine house is the sub-station plant for converting the electricity required for the working of tramways. At present this consists of three Schneider 350-kW machines delivering d.c. at 550 volts. Space for a fourth converting set is available.

The two 1,200-kVA generating sets have been in operation since November, 1922, and have been run on an average of 65 per cent. of full load at a fuel consumption of 0.682 lb. per kWh, or approximately 0.44 lb. per h.p.-hour. The 3,300-kVA set was put in operation in October last and is reported to be giving equally good results. A similar set to the latter is at present being installed and is expected to be in operation before the end of the present year. The station attendants are Chinese who were instructed in their work by the contractors and the officers of the company. The number of men required is very small so that in emergencies, as for example during a strike, the plant could be run by the European officials in charge of the station. When the installation of the second 3,300-kVA set is completed the old steam plant will be abandoned and the Diesel station will be run continuously for 24 hours per day; at the present time it is only running from 10 to 12 hours per day.

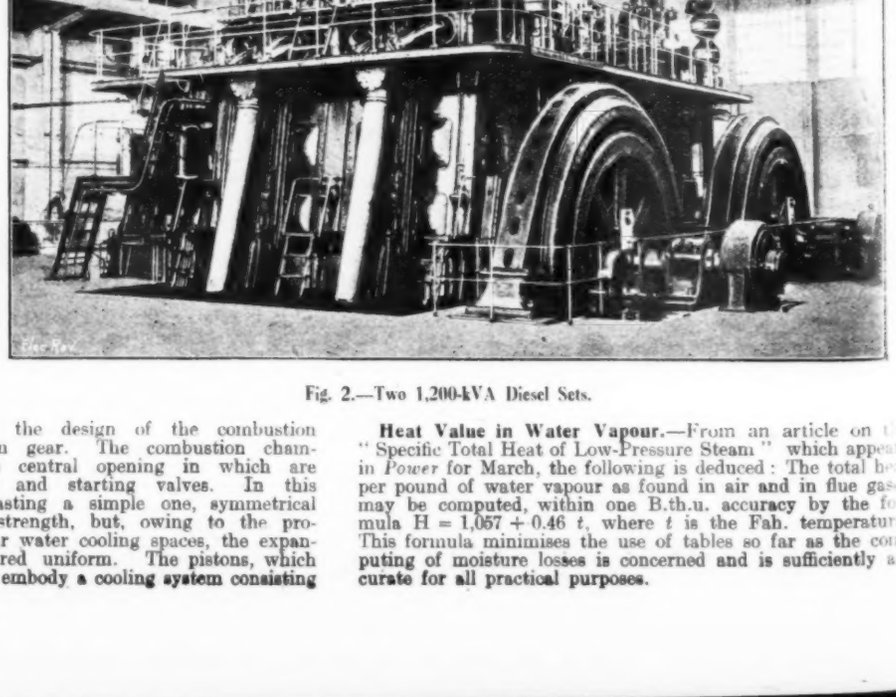


Fig. 2.—Two 1,200-kVA Diesel Sets.

Heat Value in Water Vapour.—From an article on the "Specific Total Heat of Low-Pressure Steam" which appears in *Power* for March, the following is deduced: The total heat per pound of water vapour as found in air and in flue gases may be computed, within one B.th.u. accuracy by the formula $H = 1{,}057 + 0.46\ t$, where t is the Fah. temperature. This formula minimises the use of tables so far as the computing of moisture losses is concerned and is sufficiently accurate for all practical purposes.

The Distribution of Thunderstorms.

Abstract of Air Ministry's Report.

A REPORT on "The Distribution of Thunderstorms over the Globe," by Mr. C. E. P. Brooks, M.Sc., has just been issued by the Air Ministry Meteorological Office (Geographical Memoirs No. 24, fourth number of Vol. III*), which describes an investigation that was carried out as an attempt to determine the distribution of thunderstorms over the globe, and from that datum to calculate the amount of thunderstorm activity which takes place in the course of a single day. Some 3,265 observation stations were employed in Europe, Asia, Africa, North and South America, Australasia, and the Oceanic Islands; in addition, tabulations of marine data were employed for the oceans and the results of the investigation may be of some assistance to electrical engineers in connection with the operation and protection of transmission lines and radio-telegraph stations.

Distribution of Storm Frequency.—The data were plotted on three charts of the globe, giving the figures for the year, for April to September, and for October to March. On these charts isobronts, or lines of equal frequency of thunder, were drawn, the data being expressed as percentages of days on which thunder was heard. In favourable circumstances thunder can be heard for a distance of ten or twelve miles, but the numbers represent the thunder occurring within a distance of six miles, *i.e.*, in an area of 113 square miles surrounding the station.

In drawing the isobronts a few areas were found where even the plotted figures (without regard to their reliability) were quite insufficient, notably in the eastern half of the South Atlantic Ocean, the Sahara, the interior of Australia, and the greater part of the Pacific Ocean. In these cases recourse was had to general meteorological considerations. Over the land areas—the Sahara and the interior of Australia—it was assumed that the practically rainless central areas were almost without thunderstorm activity. Over the oceans the centres of permanent high pressure and the neighbouring steady trade wind regions were considered as stable areas where thunderstorms are probably rare.

The chart for the year shows six areas of maximum frequency, in four of which the frequency of thunder exceeds 30 per cent. (110 days). These six areas are:—Southern Mexico (39 per cent.), Panama (37 per cent.), Central Brazil (29 per cent.), Central Africa (41 per cent.), Madagascar (26 per cent.), and Java (61 per cent.). The last-named is probably the most thundery region of the earth. Areas where thunder is rarely or never heard include the Arctic and Antarctic regions. The area with less than one thunderstorm a year includes Greenland, the northern half of Iceland, Northern Norway, the whole of the Arctic Ocean, and the northern coast of North America. Nearer the equator there are two belts of minimum thunderstorm activity coinciding with the sub-tropical belts of high pressure in about 30 deg. N. and S. In the northern belt the greater part of the Saharan and Arabian deserts has a probable frequency of less than 1 per cent. (four records a year), while there is another minimum area to the west of North America, where the whole coast from Alaska as far south as San Diego (32 deg. N.) has less than 1 per cent. This quiet region probably extends a long distance westward, Honolulu in Hawaii averaging only four storms per annum, but eastward it does not penetrate far on to the continent, and storms are much more frequent in the Rocky Mountain belt. In the southern hemisphere there is a well-marked minimum area on the west coast of South Africa (average three days of thunder per annum), but it does not extend more than a few miles inland to the east. The most marked deficiency of storms in this belt is along the coast of Chile from 16 deg. to 34 deg. S., where the frequency averages less than one a year, and there is an interesting local minimum along the east coast of New Zealand (average annual frequency only three, or less than 1 per cent.), while on the corresponding west coast it is about 3 per cent. This is probably a "rain-shadow" effect, although in general in temperate regions (Scandinavia and North America) the effect of a range of mountains to windward seems to be to increase the storm frequency.

The distribution in central Europe is also interesting. The average frequency is 20 days per annum (just over 5 per cent.), with a marked maximum north of the Alps, another along the eastern part of the Alpine ridge, and a minimum over central Germany. There is also a local maximum over the Dutch coast, which is due chiefly to the frequency of winter thunderstorms.

Number of Storms per Year.—The average frequency of thunderstorms over the land and coastal waters is much greater than over the sea, especially in the tropics. The only latitudes in which the frequency of thunder over the sea exceeds that over the land are between 40 deg. and 50 deg. S. in both seasons, but in 30 deg. to 20 deg. N. the figures are equal during the period October to March. In April to September the maximum is reached over both land and sea between 10 deg. N. and the equator; in October to March the land reaches its maximum between 10 deg. and 20 deg. S., the sea between 10 deg. N. and the equator, and the land and sea together between the equator and 10 deg. S. On the average, the northern hemisphere is slightly more stormy than the southern (17.1 days a year, compared with 15.4), but each hemisphere has the greatest thunderstorm frequency during its respective summer, when it is about double that during the winter.

Many storms have a broad front and most of them drift while in progress; hence, if we imagine the whole of the earth to be divided into segments, each with an area of 200 square miles, on the average 16 thunderstorms will occur each year within each segment, and on the whole the earth will experience 16,000,000 thunderstorms per annum, or 44,000 per day. The duration of thunderstorms is very variable, but a moderate estimate of the average duration will be one hour, so that there will be in progress at any one moment about 1,800 thunderstorms in different parts of the world. What does this mean in terms of lightning flashes? During a thunderstorm at West Norwood, 98 lightning flashes were counted in 28 minutes, which is at the rate of approximately 200 per hour, which figure is approximately correct for a severe temperate or an average tropical storm. Then 1,800 storms will give 360 000 lightning flashes over the whole globe in an hour, or an average of 100 per second.

Annual Variation of Frequency.—The maximum frequency occurs in summer over the greater part of the world. In Europe, northern and eastern Asia, Canada, Alaska, and the United States, the maximum falls in July and the minimum near the middle of the winter. Nearer the equator this simple distribution is disturbed; thus, southern Asia and North Africa have two maxima, the greatest in May and a secondary maximum in October, *i.e.*, at the beginning and end of the rainy season. In Central America and the West Indies there is a single maximum in August, near the middle of the hurricane season.

The equatorial regions in general show great thunderstorm activity over the land in all months. In the northern hemisphere the land has a maximum in June and July and a minimum in January, while the southern hemisphere land shows a maximum in December and January and a minimum in July. The excess of thunderstorms in the land areas of the southern over those of the northern hemisphere is merely due to the shapes of the continents.

Diurnal Variation.—Over the land the maximum generally occurs during the afternoon, when convection is strongest, and the minimum during the night or early morning. Thus, at Edinburgh, the maximum occurs at 14-15h., and 46 per cent. of the storms occur between 12h. and 16h.

Variation in Frequency with Height.—Height has remarkably little effect in determining the incidence of thunder. For instance, the mean of 15 years' observations at the observatory on Pike's Peak, Colorado, at a height of 14,133 ft., gave an annual frequency of 39.7, or 10.9 per cent., compared with 40, or 11 per cent. This agreement extends even to the individual months, July being the month of maximum frequency at high as well as low levels in both cases. Up to 1,000 or 1,300 ft. in Sweden the altitude does not exercise any appreciable influence on the number of days of thunder; between 1,000 and 2,600 ft. (300 and 800 metres) the frequency on the whole increases slightly. In the Alps a different conclusion is reached; the isobronts are extremely complicated, but show a real decrease of thunder with height in Switzerland. This is partly to be accounted for by the fact that a large proportion of the low-level stations lie in the north. In one respect the results are curiously similar to those obtained in Sweden, namely, in the much greater variability of thunderstorm frequency above 500 metres. The absence of any recognisable effect in Sweden probably shows merely that the mountains there, although lofty from an English standpoint, are not of sufficient elevation or extent to affect seriously the meteorological processes giving rise to thunder. On the other hand, in the Alps there appears to be a real diminution towards the high interior, indicating that the storms tend to be limited to the lower ground which is more level and also more moist.

* H.M. Stationery Office; price 2s. net.

Saving on Electrified Railway.—The Chicago, Milwaukee, and St. Paul Railroad of America has announced that it has saved by the electrical operation of 438 miles of line for nine years and 210 miles for five years, a total of $12,400,000. The traffic over this railroad, which boasts of being the longest main line electrified railroad in the world, consists of two heavy transcontinental passenger trains daily, with occasional special passenger and milk trains, and an average of four tonnage freight trains, with a local freight train every second day. The freight traffic amounts to 15,000 gross tons daily. The road passes over long and severe grades in the mountain ranges. Considerable saving is brought about by regenerative braking of the gearless locomotives, which are products of the American General Electric Co.

The Sale of Electricity.

Some Suggestions for Developing the Load.

By R. HARDIE.

(*Abstract of Paper read before the* WEST OF SCOTLAND SECTION *of the* E.P.E.A. *at Glasgow.*)

GENERATING costs are now perhaps as low as they need be at the moment and the cost of distribution is receiving earnest attention, but we must not assume that the market for electricity will keep pace automatically with our generating resources as it did during the war period. We must recognise the importance of finding new outlets for our product; a 30 per cent. load factor is unsatisfactory; therefore, the finding of new markets for electricity is a matter of concern, not only to men directly engaged on the sales side, but to every official and employé in the organisation. The commercial side of an electricity undertaking is likely to grow in importance. Engineers have not had to worry about the disposal of the electricity. We did not advertise. The result is that in Glasgow, and in most large cities throughout the kingdom, we have 10 per cent., or at most 15 per cent., of the houses wired for electric lighting. We must now cast our nets further, and find means of appealing to the remaining 85 per cent. of houses still unreached by our service.

Since the steps taken by Glasgow Corporation last winter to have a larger number of the smaller dwelling houses wired cheaply, we have succeeded in wiring on an average just over 100 houses per month, houses which would for the most part not have been wired in the absence of the special terms offered. In six months we have wired 640 houses made up as follows :—

1 room and kitchen	... ...	35
2 do.	... ...	240
3 do.	... ...	160
4 do.	... ...	150
5 do.	... ...	55
Total	... ...	640

In addition, in about 300 tenements the proprietor has been induced to bear the cost of erecting a main rising cable right to the top floor, which means that facilities are available to every householder in those 300 properties to take the supply from a point within three feet of the entrance to his house. The obstacle of high installation cost has been got out of the way. A two-room-and-kitchen house is wired for five lights, with a plug for an electric iron and a plug for an electric fire, at a cost of £8 10s. if paid in cash, or on a cash payment of £2 and twelve quarterly payments of 12s. 6d. spread over three years, making a total of £9 10s.

The figure of 100 houses per month may appear insignificant when we remember that there are in Glasgow at least 100,000 gaslit houses that ought to be changed over within a few years, but the results have been attained with a staff of three men, and results up to a point can be increased in direct ratio to the number of capable men employed. It is interesting work, but not easy, and calls for much evening work, interviewing householders in their own homes after working hours when husband and wife are together and prepared to discuss a scheme fully. In American cities where they wire anything from 20,000 to 30,000 old houses in twelve months, results are obtained by making the amount on the pay envelope bear some relation to the results achieved by the individual—not bad practice either.

We have employed newspaper advertising as a means of notifying the public of the new scheme, and in erecting rising mains in tenement properties we make them capable of supplying all future requirements, including heating and cooking, of every tenant. Electric fires are installed on hire in many of these houses. We have installed over 6,000 fires in two years, in addition to many thousands privately owned. That they are not entirely for decorative purposes is apparent to the station engineers, and our output has for some years past been affected in no small degree by varying climatic conditions.

The cooking load is more constant. We have at the moment 1,500 or 1,600 electric cookers on the Glasgow system, 200 of them being installed in Corporation all-electric houses at Mount Florida and in Hawthorn Street; a further 600 houses of this type, entirely without gas, are in course of construction. An electric cooker and a wash boiler are installed in the kitchenette; there is a coal fire in the living room, but the other rooms are heated by electric fires supplied as part of the house equipment.

Over 100 such houses have been working for close on twelve months, and the tenants express themselves satisfied with the results. The running costs are working out quite economically and we have visitors regularly from all over the country. Gas need not be introduced for any purpose, and it is difficult to exaggerate the importance to the electrical industry once it is accepted as standard practice that the house of the future will employ electricity exclusively for lighting, heating, and cooking.

We find it difficult in many cases to persuade yearly tenants to wire houses that are not their property, which they may be called upon to leave at any time. Personally, I am quite satisfied that such work might reasonably be done at the proprietor's expense, and probably will be at a later date when the possession of property becomes more lucrative than it is reputed to be at present.

With the new Glasgow two-part tariff it is possible to reach an average rate of three-farthings per kWh for lighting, heating, and cooking; the fixed annual charge is dependent upon the size of the house, plus a running charge of one halfpenny per kWh consumed. The additional cooking and heating load, due to diversity factor, does not materially affect the peak demand; it is possible to increase by 400 or 500 per cent. the revenue from domestic consumers without incurring expenditure on additional generating plant or mains. At a recent meeting in Leeds, on a show of hands being called for by the chairman, I was somewhat surprised to learn than 30 per cent. of those present had cookers at home, so we are moving in the right direction. The boiling plate of the cooker may not be perfect, but it is sufficiently robust and speedy in operation to perform satisfactorily all cooking operations within the home, while the electric oven and grill are easily superior to any other competitive form of apparatus. It is by learning of the difficulties met with in actual experience that the necessary improvements can be made. We have recently put forward a suggestion to manufacturers for cheaper apparatus, as we consider the high cost of appliances in the past has been a contributory factor to slow development.

Electricity supply authorities are endeavouring to build solid foundations, and they require the co-operation of every man in the industry. When in contact with the public let us all at least speak as with one voice in praise of electrical apparatus. The emissaries of the gas department can be sufficiently eloquent on the subject of electrical defects, without assistance on our part.

In other directions also the scope of our activities may be widened. The E.L.M.A. is endeavouring to bring home to existing lighting consumers the urgent need for a higher standard of illumination. The possibilities in this field are enormous; the Association recently surveyed shop lighting all over the country, and estimates that to bring it into line with latest practice will call for an expenditure on the part of shopkeepers of £50 000,000. The shopkeeper will gladly face the necessary outlay, provided the story is told him properly, and that calls for every man in the industry first learning the lesson himself. The E.L.M.A. is, in co-operation with local bodies, about to set up Illumination Bureaus in provincial centres, with facilities for demonstration, and it is proposed to tackle the various fields in rotation.

We also took part last winter in a general campaign to have shop windows lit after closing hours. Switching off is done at any predetermined hour (usually 11 p.m.) automatically by a time switch which we install at an annual rental of £1, and electricity for this late lighting is charged at 1½d. per kWh. Over 400 such switches were installed this winter, which means a desirable off-peak load in the evenings, in addition to making the streets much more attractive. The clamant need, of course, is for a "during-the-night" load. Mr. R. B. Mitchell looks for possible help from the development of a water-heating load, and another type of evening load with which we have made a start is that of flashing electric signs. Electric vehicle business undoubtedly is most attractive for night load, and there seems to be no reason why this business should not be tackled.

Pulverised Fuel and Mechanical Grate.—In an article on "Pulverised Fuel and its Application to Boiler Firing," by Mr. W. J. Cotterell, which appears in *Combustion*, some interesting particulars are given of the combined use of pulverised fuel with an existing mechanical grate at the Amsterdam electricity station. A high-speed pulveriser supplies coal to a number of burners over the back end of the grate so that the flames pass at right angles over the top of the grate surface. The pulveriser is adjusted so that less air than usual is passed through the machine, and at the burners there is not sufficient air for complete combustion, consequently the excess air from the mechanical stoker is utilised to complete the combustion of the pulverised fuel, resulting in a high combined efficiency. In this way one of the chief defects of the stoker is eliminated, since the excess air that usually passes through the ash and clinker at the end of the stoker is used. Due to the limited size of the combustion chamber, it is possible to burn only a relatively small amount of pulverised fuel, but owing to the extreme flexibility it can be used for any variations in load, while the evaporative capacity of the boiler can in most cases be increased by 15 or 20 per cent. This combination allows the steam user to take advantage to some extent of the great flexibility of pulverised coal firing.

Gas Turbines.

A Review of Current Theory and Practice.

By M. KONIG, Ing.Dipl., E.T.H.Z., A.M.I.M.E.

(*Abstract of Paper read before the* NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.)

THE enormous development of the steam turbine at the expense of the reciprocating steam engine during the last thirty years raises the question why a similar success has not been achieved by the gas turbine over the gas engine. The gas turbine certainly does offer definite advantages which justify its development.

In a "constant-pressure" turbine the chamber in which the gas is generated is always connected with the turbine, and the gas flows into the turbine continuously. Examples of the use of this cycle are the turbines of Lemale, Armengaud, &c.

In explosion or "constant-volume" turbines, the combustion chamber is closed towards the nozzles during combustion, so that the total volume remains unaltered, hence the name of constant-volume cycle. The turbines of Karavodine, Holzwarth, Rateau, Barron, Dale & Packham, &c., are examples of the application of this cycle.

At the present stage of the development of the gas turbine, only the single-stage axial impulse turbine can be considered, as temperature and materials do not, for the time being, permit the realisation of a multi-stage impulse or even a single-stage reaction turbine.

The extreme usefulness of the so-called entropy chart for steam turbine calculations has led to the introduction by Professor Stodola of the gas entropy chart for analysing the various cycles on which the gas turbine operates. Once the use of the entropy chart is familiar, it is an easy matter to investigate the relative merits of various cycles.

The Carnot cycle represents theoretically the ideal conversion of heat into work. Examination shows, however, that

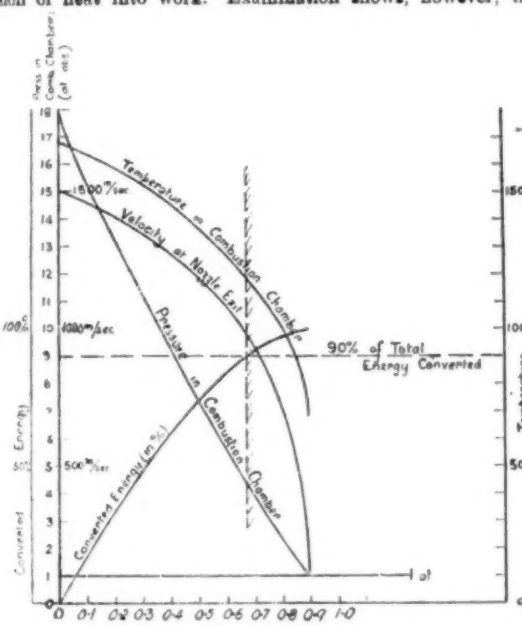


Fig. 1.—Influence of Pre-compression.

isothermal compression calls for extremely high pressure ratios, which involve negative work of such a magnitude as to make this cycle unsuitable in practice with present-day means of compression.

The constant-pressure cycle as applied to the gas turbine simplifies the construction, and provides favourable conditions for the hydraulic efficiency of the blading, since the latter is subjected to a continuous flow of gas at constant speed. The necessary high compression ratios of this cycle will, however, bar its successful application so long as present-day means of compression are not materially improved.

The constant-volume cycle was first introduced for piston engines by Lenoir and Otto, and its application to the gas turbine has become the predominant life-work of Holzwarth. The results obtained seem to show that, for the time being, the only successful solution of the gas-turbine problem lies in the application of this pulsatory combustion to a prime mover which is fundamentally more suitable for continuous admission. The main reason for this is the fact that for any given maximum working pressure, and in particular temperature, the constant-volume turbine may operate with much lower compression ratios than the constant-pressure type, and also so far as reliability is concerned, the fact that the periodic nature of this cycle enables one to maintain in the explosion and wheelcase chamber a mean temperature much below the momentary combustion temperature of from 2,600 to 3,500 deg. F.

From a purely thermodynamic point of view, the explosion cycle is superior to the constant-pressure cycle. This thermodynamical superiority is partially counterbalanced by the higher hydraulic efficiency of the turbine blading in the constant-pressure cycle. If the efficiencies of the two cycles are compared on a basis of equal maximum working pressure and temperature, instead of compression ratio, it would appear that there is no appreciable difference in pure efficiency to be expected in either case. The influence of pre-compression is shown in fig. 1. The principles on which turbines have actually been built, or proposed, represent very often a combination of the above basic cycle.

Proposals and attempts to solve the problem of compression other than by mechanical means are:—

(*a*) *Compression of the gas charge by the kinetic energy of the exhaust gases.*—This idea is the subject of a large number of patents. It is very doubtful, however, whether it will be possible to compress a gas by the impulse of another without considerably mixing the two.

(*b*) *Compression of the gas charge by a water column.*—This proposal has much to recommend it, and was first successfully employed by Humphrey in his well-known pump. Its further application to the gas turbine was proposed in a patent of Brown, Boveri, and it is used in the turbine designed by Professor Stauber.

With regard to the position of the gas turbine relative to the gas engine, the former promises fewer advantages over the piston engine and presents greater difficulties than the steam turbine.

Taking for comparison purposes a constant-pressure cycle, and assuming that the expansion of the working gases is carried down to atmospheric pressure, the theoretical thermodynamical efficiency of this process is the same for an ideal turbine as for a reciprocating machine, but in practice expansion down to atmospheric pressure cannot be accomplished with piston engines as the cylinders would be of unwieldy dimensions. The gas turbine, on the other hand, like the steam turbine, is capable of utilising the exhaust end of the indicator diagram. The increase in useful work by the addition of this end may amount to 40 per cent. if the expansion is carried down to the initial pressure, and approximately 80 per cent. if the expansion goes down to the initial temperature.

Although the gas turbine has the capability of dealing with large volumes, it is greatly handicapped in the compression of its charge, whereas in the piston engine both compression and expansion take place in the same cylinder with a high efficiency. In addition to the improvement in mechanical efficiency due to compression and expansion in the same cylinder, the efficiency of the piston compressor is in itself from 10 to 25 per cent. better than that of the turbo-compressor. An increase in compressor efficiency of 40 per cent. improves the overall efficiency by almost 70 per cent.

The gas engine has also an advantage over the gas turbine in the amount of negative work necessary to push the compressed air into the combustion chamber.

Another point which for the time being will prevent the efficiency of the gas turbine surpassing that of the piston engine, is the fact that the temperatures required are beyond the capabilities of the materials at present available.

Considering the position of the gas turbine relative to that of the steam turbine, it should be observed that the gas-turbine cycle is somewhat analogous to an abridged steam-turbine cycle. The hot gases produced by the combustion of the fuel form the working medium without the transmission of the energy to another gas, as in the case of the steam turbine. From a thermodynamic point of view, the steam cycle is relatively simple and transparent, whilst in the gas turbine chemical alterations of the gases take place during the combustion, which, in the event of incomplete combustion or unequal mixture with the extra air, make it almost impossible to follow the alteration in the gas properties with the accuracy required for fixing the dimensions of nozzles and blades.

In either steam or gas cycle, the main losses are represented by the heat contained in the exhaust gases. In the gas turbine, however, this heat is of a higher grade, and therefore easier to recover. A 60 per cent. recuperation of the exhaust losses in the gas turbine is possible. The prospects of the gas turbine may be severely cut if the modern tendency in steam turbine practice to use much higher pressures than hitherto employed proves to be commercially successful.

The most exposed parts of the turbine are the thin inlet and exit edges of the stationary and moving blading. Stodola has shown that if these edges are reasonably rounded off and are not continuously subjected to the high gas temperature, the resistance to the heat transmission will prevent their burning away.

A very thin layer of almost stagnant gas round the surface of the blades, with its viscous flow, is the real protective coat of the blading.

The stresses in the turbine disks are calculated as the superposition of pure centrifugal and pure temperature stress, according to established methods. It is the influence of the wheelcase temperature in particular that makes the question of suitable materials the vital point in gas turbine design.

The temperatures in the combustion chamber are not appreciably higher than those to be met with in internal combustion engines, and in particular, those of the Diesel type. Although it may safely be said that for the stationary parts the question of material is practically solved, many difficulties may still arise from erosion, corrosion, and distortion, and it would be unjustifiable to pretend the same with regard to blading and disk materials. The gas turbine imposes very stringent conditions, as not only must the peripheral speed of the turbine blading be high, due to the necessarily high gas speeds in single-stage turbines (a multiple-stage turbine being impossible for the time being, on account of the maximum allowable temperatures), but the ultimate tensile and yield point of the material is considerably decreased due to the temperatures. Bearing in mind the fact that temperatures of 400 to 500 deg. C. at the blading are necessary to give a reasonable efficiency, the difficulty of obtaining a suitable material is apparent.

Another important point to be watched is the behaviour of the materials against the action of sulphuric acid, which will be formed if there are traces of water in the exhaust gases.

Provision for cooling in gas turbines is unfortunately essential. Generally speaking, cooling by jacketing or scavenging is inferior to cooling by injection, as the energy thus abstracted from the working medium is mostly lost. Cooling by injection, on the other hand, means a smaller loss of energy, as the working fluid is increased by the amount of cooling quantity: *i.e.*, although the impinging velocity of the working medium on the blades is lowered, due to decrease in temperature, the total energy may remain nearly the same. Furthermore, cooling by injection of a liquid is superior to cooling by an excessive amount of combustion air, as the negative work of its compression is negligible in comparison with that of the latter.

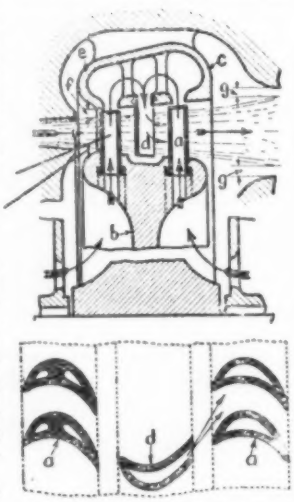


Fig. 2.—Cooling Arrangement.

A cooling arrangement proposed by the author is illustrated in fig. 2.

The internal losses may be considered in the same way as in the case of steam turbines, although present-day knowledge does not allow them to be fixed as accurately, this applying in particular to the co-efficients of nozzles and blades, especially in the constant-volume type where there is a rapid variation of the gas speed.

The actual conditions in this type are, however, easier than may be supposed. For example, from the actual working diagram of a Holzwarth turbine it may be seen that, with a pre-compression of the air to about 3 atmospheres absolute, the explosion pressure rises to 18 atmospheres, thus producing a maximum gas speed to the blading of about 1,500 metres per second, and from fig. 1 the interesting fact emerges that 70 per cent. of the available energy is utilised before this maximum velocity falls below 900 metres per second. A clearance angle of only 5 degrees would be sufficient to prevent the gases hitting the back of the blades. This factor is of fundamental importance, and explains the efficiencies obtained with the constant-volume type.

There remains, of course the heavy loss due to fan action during the relatively long scavenging period (approximately fifteen times the expansion period), when the cooling air has to be accelerated by the turbine wheel itself.

The governing problems of the gas turbine are very similar to those of the steam turbine, but are much more complicated by the required regulation of the compressor and blowers at the same time.

(To be continued.)

Electricity Supply in South Warwickshire.

Important Inquiry by the Electricity Commissioners.

On April 29th and 30th Col. T. C. Ekin, assisted by Mr. W. Cooke, held an inquiry on behalf of the Electricity Commissioners into competing applications by the Barford Electric Supply Co., Ltd., and the Leamington and Warwick Electrical Co., Ltd., for powers to supply electricity in certain parts of South Warwickshire. Mr. WILFRED BURTON, who appeared for the Barford Co., said that his clients had been supplying electricity generated by water power in Barford and Sherborne for 10 years. He wished to withdraw from his application three parishes in the rural district of Brailes on account of the "high moral attitude" assumed by the Brailes Rural District Council. The Inspector described this as an extraordinary reason for withdrawal.

Mr. Burton claimed that the Leamington and Warwick Co. showed no interest in certain of the districts under consideration until his clients applied for an Order. It had been stated that the Barford station was inadequate, but the company's associate, the Warwickshire and South Midland Electricity Supply Corporation, had a considerable holding in the Barford company, and was undertaking these extensions. He contended that the company was able to supply electricity more economically than, and quite as efficiently as the Leamington and Warwick Co. In reply to questions concerning the attitude of other authorities in the area, Mr. Burton said that he would withdraw the parish of Lighthburn, but he hoped that the Commissioners would over-rule Stratford's objection.

Mr. C. A. TURNER, C.A., who was called to give evidence regarding the finances of the Barford Co., was subjected to a searching examination by Mr. Craig Henderson, K.C., for the Leamington and Warwick Electrical Co., Ltd. He said that the subscribed capital of the Warwickshire and South Midland Electricity Supply Corporation was £23,021. The money was at present invested or at the bank. The corporation had no other assets, and a holding of £5,000 of debentures in the Barford Co. was included. Mr. Henderson, after eliciting the fact that Mr. Turner was going to act as accountant for the corporation, asked him if he had advised the public of the value of the Barford undertaking, which the corporation had acquired, when the public was asked to subscribe capital. Mr. Turner said that he had, from the figures placed before him. Mr. Henderson said that the prospectus claimed an average yearly increase of 20 per cent. in the receipts for three years, and asked if it did not matter to the public, when asked to subscribe £24,000, to know whether this increase was 4s. or £4,000. Witness said that he was not asked to put those figures. In further evidence he referred to the Barford plant as "the factory." Mr. Henderson asked him not to call it that. "Call it a 'hydraulic electric generating station'—otherwise known in the district as 'an old mill.'" In reply to a question, the witness said that Col. Eaton was behind the company, and admitted that *Truth* had described Col. Eaton as a "super-crook" and the witness as his "tame auditor." Mr. Henderson suggested that the balance sheet presented by the company was a false one; the witness said that he had had to take a lot for granted on what was told him. The Inspector expressed his dissatisfaction with the evidence of Mr. Turner, having regard to the fact that the Commissioners had asked for the fullest technical and financial information. Witness replied that a number of the questions put to him were not within his province to answer.

On the following day Mr. CRAIG HENDERSON said that the Barford application was for an Order of the smallest imaginable description on the River Avon. The undertaking had, however, done its best for the village with the money available. In 1923 Col. Eaton acquired the undertaking, and it appeared to be supplied with a capital of £2,700 and £700 from the bank, while £10,000 of debentures were created. According to the evidence the capital was something like £23,000. This "trumpery little station" was proposed as the basis of a scheme and as a justification of the company's having the right to supply electricity in the area. On the other hand, the Leamington and Warwick Co. had spent a great deal of money in fulfilling its obligations.

Representatives of the Warwickshire County Council and the Stratford Rural Council opposed the Barford Co.'s application.

Mr. F. THURSFIELD, a director of the Leamington and Warwick Co., gave evidence of his company's ability to undertake the supply of energy in the area. He said that the cost of carrying out a scheme was estimated at £29,000, and it was hoped to make the supply remunerative. A statement signed by a number of consumers of the Barford Co. was presented in opposition to that company's application on account of the "bad light" provided by the company. Another similar statement was put in by the residents of another village.

Mr. WILFRED BURTON asked if it was the intention of the Leamington and Warwick Co. to benefit by the work which his clients had been doing for the past 10 years. It was stated in reply that whatever benefit there was in goodwill was seriously discounted by the fact that the people in Barford had spent their money on a scheme of doubtful utility.

Mr. HENDERSON said that the prospectus announced that economy would be effected by "the associated working of the two companies." In reality there was only one undertaking, and he hoped that the Inspector would call the attention of the Board of Trade to the return which had been made.

Mr. BURTON said that the evidence given by Mr. Turner had created a wrong atmosphere; he was an extremely bad witness. There were certain things which could be amended and an adequate explanation could be given. He complained that he had given instructions for all the necessary books to be brought to the inquiry, but they had been disregarded.

Mr. W. O. ROOPER, the engineer of the Barford scheme, said that he would like to say that he did not associate himself with the promoters. He was the originator of the Barford station, and was asked to prepare this scheme.

The inquiry then closed.

Readers who desire a fuller report of the inquiry will find this in the issues for April 30th and May 1st of the *Financial News* and the *Birmingham Post*.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Combination Floor Polisher.

According to the *Electrical News* (*Toronto*), the UNITED ELECTRIC CO., Toronto, Ont., has recently developed and placed on the market a unique and compact combination floor polisher and utility motor. As a floor polisher this new appliance, representing a departure from what has been the common practice, is light in weight.

The design of the brush and brush drive is so arranged that the "down-pull" of the belt gives the necessary pressure which permits of the reduction in weight. The brush is mounted on a floating axle, which permits the polishing of warped or buckled floors as well as flat surfaces. All bearings are of the ball-bearing, self-lubricating type. The Universal motor is suitable for either d.c. or a.c. Fig. 1 illustrates the utility motor and brush.

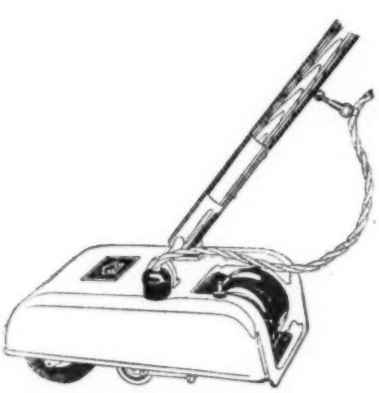


Fig. 1.—A Combination Floor Polisher.

Fig. 2.—"Heatrae" Whistling Kettle.

Fig. 3.—"Heatrae" Portable Immersion Heater, 9 to 12 kW.

The appliance is equipped with attachments for cleaning and polishing shoes, silver, knives, &c., and a separate attachment for applying the wax to the floor has been developed as an accessory to the floor polisher.

An Improved Connector for Electric Irons.

We have received from MESSRS. MAGNUM ELECTRIC APPLIANCES, 27, Old Bond Street, W.1, a sample of a new connector, for use with electric irons, &c., which they are putting on the market. This connector is somewhat similar in shape and size to the usual type, the body being made in halves, clamped together by three screws and nuts. The connecting elements and a lead protection spring are carried in slots in, and held between, the halves of the holder. The phosphor bronze contacts will, by virtue of an interlaced teeth construction, fit all sizes of terminal pegs. Either twin or triple flex may be used, and positive cord grip is arranged between the halves of the holder, the leads running in curved channels. The ends of the flexible are clamped between contacts and the terminal stampings. A special feature of the connector is an earthing device by which the provision of a third pin or special earth terminal on the iron or other apparatus is rendered unnecessary. A pin which projects under the influence of a spring, and which is connected to the earth terminal, makes continual contact with the case of the apparatus. A continuation of the earth terminal also makes connection with the lead protection spring.

The connector has a highly polished finish and the makers claim that it is fireproof.

An Electric Whistling Kettle.

What is believed to be the first electric whistling kettle to be put on the market, the "Heatrae" whistling kettle, fig. 2, is made by MESSRS. ELECTRIC FIRES, LTD., King Street, Norwich. It proves a useful safeguard against wasting current and boiling dry, and the whistle can be heard in any part of an average-sized house. The steam is trapped away from the spout so that the whistling continues until the kettle is almost empty. The elements are assembled in a copper sheath which is sweated to the bottom of the kettle. This is done, with the use of a special tool, by passing a current through the elements. The makers claim that the elements are so conservatively graded and that the thermal contact with the bottom of the kettle is so perfect that the elements will last an indefinitely long time; also that the residual heat of the elements is insufficient to cause any running of solder should the kettle be emptied immediately after switching off the current. All heavy clamp plates and fixing arrangements are dispensed with. This kettle is made in three sizes—two pints, four pints, and six pints—and exactly similar interchangeable elements (500 W) are fitted to each. The special tool for sweating the copper sheath can be obtained from the makers.

An Immersion Heater.

Another production of ELECTRIC FIRES, LTD., is the "Heatrae" immersion heater, the portable type of which has recently been placed on the market, used for heating oil or water in large tanks into which the heater is lowered. The heating blades are from 9 to 12 in. long. The depth of liquid should not be less than 18 in., to which depth the heater should be immersed. Fig. 3 shows a 9- to 12-kW portable-type immersion heater fitted with a watertight cable coupling and lifting loop. The stem is made in lengths up to about 6 ft., according to individual requirements. A strong removable guard is fitted over the heater blades to protect them from mechanical damage.

Current Limiter and Relay.

An additional form of the "Utility" current limiter has now been placed on the market by MESSRS. ELECTRICAL UTILITIES, LTD., Tudor Works, Park Royal, N.W.10. This "hotel limiter," fig. 4, is designed for use in hotels, &c., where it is desired to allow visitors to use heating apparatus only with the permission of the management. The limiter consists of two coils, lighting and heating, controlled by a rotary switch, the operating key of which is retained by the management.

Fig. 4.—The Hotel Limiter.

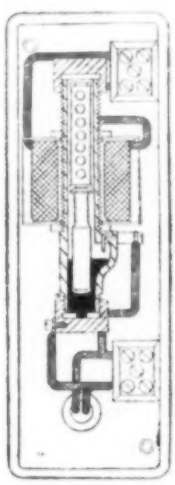


Fig. 5.—The "Utility" Relay.

The "Utility" relay, made and placed on the market by the same firm, is arranged as shown in fig. 5, with two terminal blocks, so that the coil leads are brought to one block and the contact leads to another. The coil may be either shunt or series wound and the relay arranged to either "make" or "break" the circuit when the coil is excited. One interesting use to which the relay can be put is in connection with a joint lighting and storage type water supply. The coil is connected in series with the house lighting load, and the contacts in the circuit of the heater; then if and when the lighting load exceeds a certain value, the heater is temporarily cut out of the circuit. This enables a special rate for heating, to be applied only when the lighting load is small, to be made, thus benefiting both consumer and supply authority.

A New Cubicle Interlock.

The General Electric Co., Ltd., of Magnet House, Kingsway, recently produced an interlocked cubicle, the feature of which is that the link chamber door can be closed at all times, and not only when the circuit-breaker compartment door is closed. Therefore, inspection and cleaning operations may be carried out in the circuit-breaker compartment with the link chamber door locked, and contact with the interior rendered impossible, and nothing in the circuit-breaker compartment can be made alive, because the links cannot be operated until the circuit-breaker compartment door is closed.

In addition to the isolating-link chamber door and the top and bottom doors of the circuit-breaker compartment, there is provided a plate which overlaps the chamber doors. So that the isolating links cannot be opened till the breaker is open, a cam is fixed to the isolating link spindle and a plunger connected to the breaker operating gear engages with a slot in the cam when the breaker is closed, thus preventing the spindle which operates the links from rotating. To prevent the door of the isolating link chamber being opened before the links are opened, the operating hand wheel is fixed to the overlapping plate, and it engages with a groove in the end of the isolating link-operating spindle by means of a "dog," which can only be inserted in or withdrawn from the groove when the links are in the "off" position. Accidental access to live metal is prevented by the arrangement of the overlapping plate. Though the link-chamber door may be closed, the links cannot be closed till the overlapping plate is shut, because the link-operating handle is fixed to the overlapping plate; therefore the oil-switch compartment is entirely dead. Before the oil-switch compartment is made "live," the overlapping plate must be shut so as to permit of the operation of the links, but the shutting to of the overlapping plate necessitates, first, the closing of both oil-switch compartment doors; thus, the links cannot be operated until the whole cubicle is closed.

The Fixation of Nitrogen.

The Casale Process.

On April 30th, Dr. J. F. Crowley entertained to dinner in London the Conseil d'Administration of the Casale Ammonia Co., and Dr. Luigi Casale, the inventor of the important process for the fixation of atmospheric nitrogen which bears his name. We are informed that during the last few months British financial interests have participated in this company, which is the first of its kind to control international patents and represents world-wide interests. It is stated that considerable interest has been taken in the process because of this fact and the essential importance of nitrogenous products during the late war. The Casale process is the first to make extensive use of electrolytic hydrogen; with the latest type of electrolytic cell, one form of which is said to yield 7.22 cu. ft. of hydrogen per kWh, a standard Casale plant with a daily output of 7½ tons of anhydrous liquid ammonia will absorb about 5,000 kW continuously. Thus, in contrast to the Haber process, it is suitable for absorbing intermittent "off-peak" power.

Following the loyal toasts, the chairman, Dr. J. F. Crowley, proposed the health of Dr. L. Casale. The importance of the electrochemical industries was indicated by the facts that over two million h.p. of electrical energy was being absorbed by them to-day and that they were the cause for the investigation of hydro-electric schemes throughout the world. . . . "fertilisers, foods, dyes, drugs, and explosives—the fields and application of combined nitrogen are almost co-extensive with civilisation itself." In 1912 almost 58 per cent. of the world's consumption of combined nitrogen came from the natural deposits of Chilean nitrate, 38 per cent. from by-product ammonium sulphate, and only 4.5 per cent. was a directly factory manufactured product. In 1920 barely 30 per cent. was obtained from Chilean nitrate, and only 26.5 per cent. from by-product ammonium sulphate, while 43.2 per cent. was produced by nitrogen fixation processes—figures which indicated a truly remarkable growth.

During the late war, in order to enable Italy, which had much water-power, but practically no coal, herself to manufacture a large share of the fixed nitrogen she required, the Italian Government induced Dr. Luigi Casale (then lecturer in the University of Turin), to resign his teaching appointments and undertake research. He started work in 1916, but the means available being quite inadequate, only slow progress was made. At a late stage, Mr. Rene Leprestre, an American financier who had large interests in Rome, provided the necessary money for the work to be carried on on an extended scale. In 1920 ammonia was produced for the first time in the laboratory, and an initial semi-technical plant was set up for the continuous production of about 300 kg. of ammonia per day. Plant to produce 1,000 kg. daily was immediately installed; in July, 1923, plant capable of producing three tons came into operation, and an installation had been completed with a capacity of 7½ tons per day.

Dr. Crowley said that the progress of the Casale process had been very rapid since 1923, but London financial circles did not always realise the importance of the ability to produce synthetic ammonia. That ability carried with it political power. The rights for the Casale process had already been taken up in most countries of the world, and plant was now in operation in Italy, Spain, Switzerland, Japan, and the United States, while a considerable amount of further plant was being constructed for other countries. When his late colleague, Dr. J. A. Harker, O.B.E., F.R.S., was instructed in 1923 to report on the Casale process, he cabled that it differed in detail greatly from existing processes, was simpler, and less costly to install. He was much pleased with it and recommended that negotiations for the rights should be entered into. During the last six months the French Government (which had open to it under the Treaty of Versailles the rights to a great German process, and in any event was under agreement to pay royalties on that process), had decided to install at Toulouse Casale plant capable of producing 120 tons of ammonia per day, or approximately 500 tons of sulphate, if the ammonia were fixed in that form.

When the British and French Commission attached to the Inter-Allied Control Commission visited the German nitrate works at Oppau in 1919, it was told by the Germans that even if France and Britain could erect identical plant it could certainly not be operated for lack of highly trained workers who were absolutely essential. Simplicity of operation was one of the most striking features of the Casale process, and the installation which Dr. Harker had investigated was put in operation only two days before his arrival at Terni, but he found it working perfectly normally as if the staff had been long accustomed to its operation—which indicated the success that Dr. Casale had achieved.

Dr. L. Casale briefly acknowledged the toast in Italian.

Mr. George Balfour, M.P., J.P., proposed the "Conseil d'Administration of the Casale Ammonia Co.," explaining that their aim had been to form a group to join with their Continental friends and co-operate in the exploitation of the process. Dr. Casale might rely on the co-operation of financial interests in London.

Following Mr. T. P. O'Connor, M.P., the toast was replied to in French by M. Hippolyte Bouchayer, president of the Casale Ammonia Co.

"The Chemical Industries" was proposed by Col. R. K. Morcom (B.E.A.M.A.), and in responding Dr. G. C. Clayton, C.B.E., M.P., pointed out that synthetic ammonia production had been made successful in Germany because that country realised that if it was to carry on a world war it must make itself independent of the world regarding nitrogen products. Haber plant had been working satisfactorily in this country, but to be successful it had to be operated on a large scale; moreover, there was only one plant, which was a dangerous state in these days of air raids. The Casale plant could be made in smaller units and danger could be obviated by the provision of a number of installations. Many sources of ammonia were desirable for the production of fertilisers and explosives, and he accordingly welcomed the Casale process to this country as a stand-by.

Mr. W. B. Woodhouse, president of the I.E.E., proposed the health of the chairman, who responded briefly.

Russian Notes.

The Leningrad Electrical Industry.

A special committee of the Supreme Council of National Economy has presented a report on the proposed development of the electrical industry in Leningrad during the next five years. In the case of the Weak Current Trust (telephones, telegraphs, radio apparatus, &c.), the scheme provides for an increase in the production of 16,500,000 roubles in 1928-29, which will render necessary the increasing of the capital from 8,000,000 roubles to 10,000,000 roubles by October, 1929. For this purpose the committee considers it necessary to allow the trust to retain 62 per cent. of its profits every year. The Electrical Machine Trust, which turned out manufactures to the value of 1,957,000 roubles in 1923-24, is gradually to increase its production to 5,349,000 roubles in 1928-29. In the opinion of the committee the rate of development proposed is in accordance with the technical possibilities of production, provided that the plant at the works of the trust is augmented at an expenditure of 870,000 roubles and that the Reks works, which is now at a standstill, is set in operation again. The five years' programme for this trust provides for a production corresponding to 174 per cent. of the pre-war output. Most of the augmentation in the production will apply to the construction of machines. In 1926-27 it is intended to restart the Electro-apparatus works. It is suggested that it will be possible to carry out the scheme by the provision of supplementary funds amounting to 18,298,000 roubles, which are to be rendered available by permitting the trust to retain its profits, by long-term loans, by increasing the share capital, and by the raising of credit for 4,000,000 roubles.

Copper Production.

According to a report presented to the Electric Planning Commission, the Ural Copper Trust is the only undertaking which is now mining and smelting copper ore. Its productive capacity is 13,600 tons per annum, but only two of the works incorporated in the trust, with an annual output of about 4,000 tons, are in activity. The demand in 1923-24 amounted to 16,100 tons and was covered by the working up of scrap copper. The requirements in the present year are estimated at over 25,000 tons, of which a portion will have to be obtained from abroad. Until 1914 five works were engaged on the refining of copper and three of these are now in operation and

must, it is said, produce 13,600 tons of copper for electrical purposes.

A New Hydro-Electric Works.

The Council of Labour and Defence has received a report from a committee which has investigated the question of the construction of the proposed Zemo-Avchal hydro-electric works in the South of Russia. The original estimates of 6,900,000 roubles have been increased to 10,675,000 roubles, and the station is to be completed by October, 1926.

Extension of Schatur Station.

The Electric Planning Commission has decided that it is necessary to order abroad a third turbo-generator of 16,000-kW capacity for the Schatur station.

Large Turbo-Generator from France.

It is announced that a contract was entered into in Paris on April 10th, between representatives of the Baku Oil Trust and the Société Rateau for the delivery by the latter of a 5,000-kW turbo-generator at the price of $205,000. The payments are to be spread over twelve months from delivery.

Orders for England.

It is announced from Leningrad that a representative of the Volkhoff station has left for England in order to conclude a contract with Vickers's for transformers for the second substation and for other electrical equipment. The value of the orders is 900,000 roubles and the work is to be completed at the end of this year.

Electric Railway in South Russia.

Among the schemes discussed at a recent meeting of the Electric Planning Commission was the construction of an electric railway between Sebastopol and Yalta and the electrification of the southern coast of the Crimea. The commission expressed the desirability of the formation of a company, partly composed of local interests and partly of interests in Central Russia, for the execution of these works, and it was considered necessary for the works to be aided by the State.

Radio Apparatus Manufacture.

A great development is taking place in the use of radio apparatus which is manufactured by the Weak Current Trust. During 1923-1924 the trust had a turnover amounting to 1,120,000 roubles; in the three months ended with last December the value of the sales reached 891,000 roubles and in January, 1925, the turnover was 350,000 roubles, while further progress was made in February and March. The apparatus is produced at the former works of the Siemens and Halske Co. in Leningrad, the former Gessler works and the former Ericsson works.

Railway Electrification.

As a result of an investigation of the situation of traffic on the Northern (Moscow) railways, the National Commissariat of Ways and Communications has reached the conclusion that the suburban traffic, which was represented by only 8,500 passengers per day in 1913 and reached 22,100 in 1924, will be increased to 50,000 persons per day in 1932. It is considered that a sum of 14,000,000 roubles is needed for the conversion to electric traction of the line between Moscow and Pushkino and a similar amount for the Moscow-Kazan line. Owing to the insufficiency of funds the Commissariat has put forward the question of making a beginning with the section between Moscow and Losinoostrovska at an expenditure of 2,000,000 roubles, and the Moscow Soviet has asked the Council of Labour and Defence to assign 2,000,000 roubles for the works in 1924-25 and a further sum of 1,000,000 roubles in the following year.

The directors of the North-Western Railways have prepared a scheme for the electrification of the Oranienbaum lines both for passenger and goods traffic. The expenditure on the conversion of the Leningrad-Strelna-Oranienbaum lines is estimated at 3,750,000 roubles, while that on the Oranienbaum-Krasna Gorke line is put at 700,000 roubles. It is calculated that it would be possible to redeem the outlay in from five to six years, and that the work could be carried out in two years. The Electric Planning Commission proposes the provision of 2,000,000 roubles in 1925-26 for the execution of the work, which would be a charge on the estimates of the Railway Commissariat.

Electrically-propelled Aeroplane Carrier.—An aeroplane carrier the U.S.S. *Saratoga*, was launched on April 7th at the New York Shipbuilding Yards in Camden, N.J. This ship, which is the longest naval craft in the world, 874 ft., will carry a generating plant capable of developing 180,000 h.p. The plant, which will be supplied by the General Electric Company of America, will consist of four 35,200-kW turbo-generators, supplying energy to eight 22,500-h.p. motors, for the ship's propulsion. The turbines will be operated by steam from 16 oil-fired boilers.

The speed of the *Saratoga*, which will be a floating aeroplane field, will be 33 knots. The deck will be so immense and so unobstructed that it will resemble a small-sized marine drill ground, and because of the minimum deck apparatus, the vessel will seem unusually low in the water. The beam of the ship is 105 ft.

Parliamentary.

[By Our Special Parliamentary Reporter.]

The Budget.—The House of Commons reassembled on April 28th to hear Mr. Churchill's "Budget" statement. His proposals included a return to the gold standard forthwith; a comprehensive insurance scheme for widows, with a reduction of the qualifying age for old-age pensions from 70 to 65 and abolition of the "means" test; standard rate of income tax reduced from 4s. 6d. to 4s., with relief to earned income increased from a deduction of one-tenth to a deduction of one-sixth, subject to a maximum deduction of £250; reduced super-tax and increased death duties; re-imposition of the McKenna duties of 33⅓ per cent. on imported motor-cars, clocks, kinema films, &c.; increased preferences on Empire dried fruit, sugar, tobacco, and wine; and new duties on silk, artificial silk, and hops. The estimated total revenue for 1925-26 is £801,060,000, and the expenditure £799,400,000, leaving a surplus of £1,660,000.

In the course of his speech Mr. CHURCHILL said that we had now resumed our international position as a gold standard country, and over the whole area of the British Empire and over a very wide and important area of the world there had been established one uniform standard of value to which all international transactions were related and could be referred. The Chancellor expressed the belief that the establishment of this great area of common arrangement would facilitate the revival of international trade and of inter-Imperial trade, a revival which was more important to us than to any other country. The rapid changes of Government in recent years had not conduced to public economy, but with the prospect of a period of settled government and continuity of policy a strict and prompt revision of Departmental expenditure was indispensable and would be made.

With regard to the trade outlook the Chancellor did not feel justified in budgeting for any substantial expansion. They might *hope*, but the Treasury could not build its Budgets upon hope. If there were a marked improvement of business there would be a windfall for the Treasury. He had not made provision either for war abroad or for industrial convulsions at home. Income tax would benefit under the three-years' average by the deplorable trading results of 1921 passing out of account. The twin objectives of public policy at present were:—Security to the home of the wage-earner against exceptional misfortune and the encouragement of enterprise through the relief of the burdens resting on industry. The insurance scheme proposed was a far-reaching measure of social reform. The re-imposed McKenna duties were estimated to produce 1¼ millions in the first year and three millions in a full year.

Mr. Churchill said:—"I hope, by liberating the production of new wealth from some of the shackles of taxation, the Budget may stimulate enterprise and accelerate industrial revival, and that, by giving a far greater measure of security to the mass of wage-earners, their wives, and children, it may promote contentment and stability and make our island home more truly a home for all these people."

The Mining Industry.—On April 28th, Mr. BATEY, a Labour member, called attention to the present state of the mining industry, which, he said, was in a serious position. In Durham 75 pits had been closed in 12 months. Our export trade had declined, and the only remedy for the industry was a subsidy from the Government to tide over the bad times.

Colonel LANE-FOX, the Secretary for Mines, said the Government was doing all it could to develop and encourage the process of low temperature carbonisation. It had been impossible hitherto to find any process which was a commercial proposition. Government research was still going forward, and he hoped to be able to make an announcement before long. The Government had also in view considerable schemes in the way of the development of the electricity supply and other ventures, which would, he hoped, increase the demand for coal. As to a subsidy, the Government could not subsidise one industry alone.

Smoke Elimination.—On April 28th, SIR HARRY BRITTAIN asked the Secretary for Mines whether any practical proposals were being considered by his Department to put into operation, with the least possible delay, the scientific treatment of coal on a commercial basis to eliminate the smoke in cities and towns and conserve the valuable by-products which were wasted.

Colonel LANE-FOX said that the question was being carefully examined by his Department, in conjunction with the Department of Scientific and Industrial Research; but he was not yet in a position to add anything to what he had already said.

Private Bills.—On April 28th, the Haley District Gas Co. (Electricity Supply) Bill was read a second time.

On May 4th, the South Wales Electrical Power Distribution Company Bill and the Great Western Railway Bill were read a second time in the House of Commons. The third reading of the London Electricity Supply (Nos. 1 and 2) Bills and the North Metropolitan Electric Power Supply Company Bill was deferred until May 7th, objection to the Bills being taken by Labour members. A number of amendments to be moved on the third reading have been put down by Labour members.

"Beam" Stations.—On April 28th, SIR WM. MITCHELL-THOMSON, Postmaster-General, informed Sir Harry Brittain that, according to information received from the Union Government, the "beam" station in South Africa for Empire radio communication was expected to be completed early in September. The corresponding station in this country was due to be completed by October 7th; and trials between the two stations should not, therefore, be held up for any appreciable period after the completion of the South African station. Some unavoidable delay had occurred in the provision of sites.

Imports and Exports of Arc Lamp Carbons.—On April 28th, SIR P. CUNLIFFE-LISTER, President of the Board of Trade, informed Mr. Hannon that the following statements showed the quantities and values of electric lighting carbons imported and exported from Great Britain and Northern Ireland in the periods specified, distinguishing the principal countries from or to which consigned:—

(A) IMPORTS OF ELECTRIC LIGHTING CARBONS.

Country whence consigned.	1923 (a)		1924.		Jan.-Mar. 1925.	
	Quantity	Value.	Quantity	Value.	Quantity	Value
	No.	£	No.	£	No.	£
Denmark	20	1	8,930	128	4,337	43
Germany	1,884,243	7,553	2,627,973	10,117	907,909	3,141
Belgium	62,135	215	—	—	1,260	73
France	368,265	770	267,547	1,781	64,230	290
Switzerland	—	—	153,162	582	100	1
Spain	849,110	2,238	715,933	1,704	158,500	358
Italy	—	—	40	1	50	5
Austria	1,795,865	4,393	1,914,779	5,671	251,598	647
United States	428,759	5,393	459,839	4,716	71,936	1,094
Irish Free State	—	—	1,000	10	—	—
Total Imports	5,988,397	20,473	6,149,134	24,710	1,459,920	5,652

(B) EXPORTS OF ELECTRIC LIGHTING CARBONS FROM GREAT BRITAIN AND NORTHERN IRELAND.

Country to which consigned.	1923 (a)		1924.		Jan.-Mar. 1925.	
	No.	£	No.	£	No.	£
Mexico	18,000	69	2°,400	119	—	—
Chile	316,220	2,148	454,800	2,622	—	—
Other Foreign Countries ...	820,423	889	155,660	864	3,235	82
Total to Foreign Countries...	654,643	3,106	630,860	3,005	3,235	82
British India	49,646	813	45,582	955	5,600	54
Australia	195,755	2,984	53,900	933	27,700	172
Other British Possessions ...	51,827	731	301,154	2,776	156,925	799
Total to British Possessions	297,228	4,528	400,636	4,664	190,225	1,025
Total Exports	951,871	7,634	1,031,496	7,669	193,460	1,107

(a) Prior to April 1st, 1923, the particulars relate to the trade of Great Britain and the whole of Ireland.

Wolverhampton Corporation Bill.—This Bill which, *inter alia*, empowers the Corporation to run trolley and motor-omnibuses over certain routes, was considered by the Local Legislation Committee of the House of Commons on April 30th. This part of the Bill was opposed by the Wolverhampton Electric Tramways Co. and certain local authorities.

SIR LYNDEN MACASSEY, K.C., stated that the clause in the Bill was required to give sanction to certain conversions of tramways to the trolley system which had been approved by the Ministry of Transport. He explained that outside the boundaries of Wolverhampton and Walsall and between those two towns the track was the property of the Wolverhampton Electric Tramways Co., and the two Corporations worked their systems as far as Willenhall. The local authorities of the latter place and Heath Town had the option, in 1927-8, of purchasing the portions of the route which traversed their areas. The track between Wolverhampton and Willenhall was in a bad state of repair, and the Corporation considered that it would be cheaper to substitute a railless trolley system for it. Willenhall and Heath Town opposed this, as they did not wish to be compelled to buy an uneconomic and unworkable portion of line. Sir Lynden Macassey said that his clients were willing to undertake not to exercise their trolley-vehicle powers without the consent of these authorities, but they were not prepared to undertake the reconstruction of the track.

The Chairman of the Committee (Sir Thomas Robinson) thought that the authorities concerned should confer as to the best means of surmounting the difficulty.

This was agreed to, and the Committee adjourned.

Fire-Resistant Cast Iron.—According to *Machinery*, a process of metal casting has been developed by which a layer of aluminium is formed on the metal surface, which alloys more or less with the body of the metal. Castings are poured in moulds containing a network of aluminium wires; the aluminium is absorbed and a hard alloy layer forms on the surface of the casting, which gives as good a protection against high temperature as in the case of aluminium externally applied. Probably some protection for electrical equipment subject to weather exposure could be found in this direction.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1923.

31,371. "Sockets or holders for the thermionic valves of wireless systems and apparatus for telephony and telegraphy." R. Woods. December 13th, 1923. (231,923.)

1924.

215. "Protective apparatus for use in connection with the electric pumping machinery replenishing the sealing liquid in dry gas-holders." E. C. R. Marks (Maschinenfabrik Augsburg-Nurnberg Akt. Ges.). January 3rd, 1924. (231,928.)

563. "Control of apparatus at an electric power sub-station from a central control office." Automatic Telephone Manufacturing Co., Ltd. March 30th, 1923. (213,537.)

1,018. "Electric switchgear." A. Reyrolle & Co., Ltd., and J. Mirrey. January 14th, 1924. (231,947.)

1,054. "Illuminated signs or the like for advertising and other purposes." R. J. Simpson. January 14th, 1924. (231,950.)

1,086. "Variable inductances." N. H. Clough. January 14th, 1924. (231,952.)

2,213. "Self-starting synchronous motors." Crompton & Co., Ltd., and H. O. Burge. January 28th, 1924. (231,963.)

2,303. "Thermionic amplifying circuits for telephony." F. G. A. H. Voigt. January 29th, 1924. (231,972.)

3,045. "Methods of supporting electrical inductance coils and the like." F. H. Haynes. February 6th, 1924. (Cognate application 13,075/24.) (231,978.)

4,579. "Dynamo-electric generators for electric welding." J. H. St. H. Mawdsley. February 22nd, 1924. (Addition to 208,268.) (231,984

5,281. "Overload relay for electric oil switches carrying large currents." Voigt & Haeffner Akt. Ges. March 15th, 1923. (212,894.)

5,429. "Automatic circuit-breakers, especially those adapted for use in connection with electric track protection." Igranic Electric Co., Ltd., and M. J. Rantzen. March 3rd, 1924. (231,993.)

5,739. "Apparatus for the electrodeposition of metals on wire and strip." J. A. Parker. March 6th, 1924. (231,997.)

6,312. "Packings for fitting electrical sunk-type switches or pushes." J. H. Gath. March 12th, 1924. (232,006.)

7,385. "Thermionic valves." G. A. Miller. March 24th, 1924. (232,022.)

8,599. "Automatic telephone exchanges." Siemens Bros. & Co., Ltd., and C. Lambert. April 5th, 1924. (232,031.)

8,991. "Electric heaters." W. W. Weir. April 11th, 1923. (210,251.)

9,806. "Protecting devices for alternating-current systems." International General Electric Co. Inc. April 21st, 1923. (214,646.)

11,998. "Loud speakers especially for use in connection with wireless apparatus." Johnson & Phillips, Ltd., and W. H. Johns. May 14th, 1924. (232,055.)

12,898. "Electromagnetic brakes." W. H. Scott. May 2nd, 1924. (232,063.)

13,114. "Electrical condensers." W. Dubilier. February 14th, 1924. (229,239.)

14,709. "Device for preserving vegetables and like materials by means of electricity." H. D. Fitzpatrick (O. Meyer-Kelker et Cie.). June 18th, 1924. (232,075.)

15,682. "Electric heating units." Metropolitan-Vickers Electric Co., Ltd. July 6th, 1923. (218,051.)

17,141. "Electric welding jigs." F. B. Dehn (E. G. Budd Manufacturing Co.). July 17th, 1924. (232,084.)

18,234. "Method of and apparatus for effecting the commutation of electric currents." N. Japolsky. July 30th, 1924. (232,092.)

18,737. "Electric discharge tubes." Naamlooze Vennootschap Philips Gloeilampenfabrieken. August 14th, 1923. (220,620.)

18,984. "Tungsten arc lamps." General Electric Co., Ltd. March 13th, 1924. (230,777.)

19,483. "Galvanometers and like recording instruments." Telegraph Construction & Maintenance Co., Ltd., and J. Riddle. August 14th, 1924. (232,096.)

19,904. "Method of and apparatus for filtering electric currents." Roder Appliance Co. Inc. December 12th, 1923. (226,162.)

20,095. "Electrical switch mechanism." E. C. R. Marks (National Carbon Co. Inc.). August 25th, 1924. (232,100.)

20,446. "Electric condensers for voltage measurements." E. Haefely and Cie. Akt. Ges. September 6th, 1923. (221,495.)

21,020. "Electric blasting detonators." W. Eschbach. April 24th, 1924. (232,104.)

21,978. "Machines for making glass stems for electric lamps and the like." British Thomson-Houston Co., Ltd. October 9th, 1923. (225,204.)

23,198. "Electromagnetic overload time-element tripping mechanisms for alternating-current circuit-breakers." Fabrik Elektrischer Apparate sprecher and Schuh Akt. Ges. in Aarau. July 15th, 1924. (232,117.)

23,382. "Systems of electric distribution." British Thomson-Houston Co., Ltd. November 6th, 1923. (224,510.)

25,062. "Bath for use in the electrical treatment of physical ailments or disabilities." E. R. G. Greville and F. W. Read. October 2nd, 1924. (232,126.)

25,555. "Electric condensers." Dubilier Condenser Co. (1925), Ltd. (L. E. Menut). October 27th, 1924. (232,129.)

25,828. "Electric cells." A. Cellino. October 29th, 1924. (Convention date not granted). (225,197.)

26,206. "Crystal detectors for wireless apparatus." H. F. Bowers and E. V. Bowers. November 3rd, 1924. (232,130.)

26,615. "Amplifying horns for talking machines and the like." R. Brenchley. November 8th, 1923. (224,551.)

26,901. "Device for improving the efficiency obtained in the operation of multiple frequencies by means of frequency transformers." C. Lorenz Akt. Ges. February 13th, 1924. (229,260.)

26,937. "Means for the accommodation of the slack of suspended cables and like flexible members produced by lifting and lowering apparatus." A. Hauck. December 8th, 1923. (225,835.)

27,834. "X-ray tubes." Naamlooze Vennootschap Philips Gloeilampenfabrieken. November 26th, 1923. (225,540.)

29,945. "Vacuum electric tube devices." Westinghouse Electric and Manufacturing Co. December 21st, 1923. (226,531.)

1925.

4,280. "Conductors loaded with wound-on conductors." Dr. U. Meyer. February 16th, 1924. (229,349.)

7,127. "Telephone systems." Siemens Bros. & Co., Ltd., and H. E. Humphries. January 15th, 1924. (Divided application on 1,192/24.) (232,154.)

Dock Plant at Sunderland.—The River Wear Commissioners, at Sunderland, have decided to replace the hydraulic installation by electrical plant for operating (1) the lock gates and bridge, (2) the hydraulic cranes and capstans on the Laing warehouse and Hendon Dock quays, and (3) the Junction Bridge, at the South Dock. The change involves an estimated expenditure of £2,500, which will result in an annual saving of about £300 in working expenditure.